



**Assessment of antenatal and intrapartum referrals to Mowbray
Maternity Hospital in Cape Town, South Africa**

By

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Abbreviations

ANC	Antenatal Care
ART	Anti-Retroviral Treatment
BEmOC	Basic Emergency Obstetric Care
BMI	Body Mass Index
CEmOC	Comprehensive Emergency Obstetric Care
CHC	Community Health Centre
DoH	Department of Health
EmOC	Emergency Obstetric Care
EOC	Essential Obstetric Care
GSH	Groote Schuur Hospital
HIV	Human Immunodeficiency Virus
IQR	Inter Quartile Range
MMH	Mowbray Maternity Hospital
MMR	Maternal Mortality Ratio
MOU	Midwife Obstetric Unit
NCCEMD	National Committee for Confidential Enquiry into Maternal Deaths
NSH	New Somerset Hospital
PEP	Perinatal Education Programme
PPIP	Perinatal Problem Identification Programme
SD	Standard deviation
WHO	World Health Organization

DEFINITIONS

Antenatal referrals: pregnant women presenting with particular risk factors requiring referral during the antenatal period from primary level to a higher level of care for antenatal care and hospital delivery (Department of Health [DoH], 2007:30).

Intrapartum referrals: patients experiencing problems during labour requiring referral from primary level to higher level of care for hospital delivery (DoH, 2007:65).

High risk pregnancies: pregnant women presenting with maternal or fetal risk factors that require continuous additional care from doctors (Perinatal Education Programme [PEP], 2009:20).

Low risk pregnancies: patients who have no maternal or fetal risk factors present and can receive primary care from a midwife (PEP, 2009:20).

Midwife obstetric units: 24 hour comprehensive obstetric health facilities run by midwives for women with low risk pregnancies (DoH, 2007:14).

Perinatal Problem Identification Programme: is a well-developed audit tool for assessing perinatal quality of care through auditing perinatal deaths (DoH, 2007).

ABSTRACT

Introduction

A continuous and concerning increase in the number of deliveries at Mowbray Maternity Hospital (MMH) has been noted over the years and now comprises a greater proportion of deliveries compared to deliveries conducted by midwives at midwife obstetric units (MOUs). To date there have been no studies assessing the changes in the pattern of deliveries at MMH. This study describes the antenatal and intrapartum referrals at MMH in 2005 and 2013, to identify any changes and whether or not referrals are appropriate.

Method

This is a descriptive study with an analytic component involving review of a sample of hospital folders (138 for 2005 and 246 for 2013) of women who delivered at MMH from January to December 2005 and 2013.

Results

The mean age of referred women was 27.259 (SD \pm 6.277) years and 27.326 (SD \pm 6.025) years in 2005 and 2013, respectively, with no significant statistical difference ($p = 0.918$). There was also no significant statistical difference ($p=0.056$) in the proportion of coloured, black or white women who delivered at MMH during 2005 and 2013. In 2005, a total of 27 (52.2 %) delivered women were single, 54 (39.1%) were married and two (1.4%) were divorced. In 2013, a total of 178 (72.4%) women were single, 65 (26.4%) were married and three (1.2%) were divorced, with a significant statistical difference ($p < 0.001$). In 2005, 75 (54.3%) women were unemployed and 46 (33.3%) were employed, whereas in 2013, 172 (69.9%) women were unemployed and 69 (28%) were employed, which shows a significant statistical difference ($p < 0.001$). In 2005, women mostly resided in Mitchell's Plain (32.6%), Gugulethu (28.3%) or in Khayelitsha (27.5%). In 2013, most women resided in Mitchell's plain (33.7%), Gugulethu (24.4%), Retreat 48 (19.5%) and Southern Peninsula 31 (12.6%), which represents a significant statistical difference ($p= 0.001$).

The median parity for 2005 sample was 1 (IQR: from 0 to 2), while in 2013 it was 1 (IQR: from 0 to 1). Although most women (94.2% versus 95.1%) booked at antenatal clinics in 2005 and 2013 respectively, with no significant statistical difference ($p=0.697$), the gestational age at first ANC differed significantly ($p < 0.001$) (median 24 versus 19 weeks). In 2005, the median number of ANC visits was five (IQR: from 4 to 7) visits, whereas the median was six (IQR: from 5 to 8) visits in 2013, with a significant statistical difference ($p=0.013$). Over half of referred women (55.8% and 50.8%) in 2005 and 2013 respectively were delivered by normal vaginal delivery. The remainder had either a caesarean section or assisted delivery, with no significant statistical difference ($p=0.139$).

Most women were referred from MOUs in both 2005 and 2013, at 90.6% and 85.45% respectively, with a significant statistical difference ($p < 0.001$). During both years virtually all pregnancies were considered high risk and the most common reason for referral was previous caesarean section (18.8% versus 19.9% respectively). For both years most pregnancy referrals experienced one, or more, antenatal risk factors, mainly previous caesarean section at 31 (12.5%), obesity at 27 (11%), prelabour rupture of membranes at 26 (10.6%) and HIV at 24 (9.8%) in 2005 and previous caesarean section accounted for 56 (11.1%), prolonged pregnancy for 51 (10.1), obesity for 50 (9.9%), HIV for 50 (9.9%) and tobacco use for 42 (8.3%) in 2013. The difference was statistically significant ($p < 0.001$). In 2005, the main intrapartum risk factors were fetal distress (23.6%), failure to progress and preterm labour (18% each). In 2013, fetal distress was most common (36.2%), followed by failure to progress (16.7%). The difference is statistically significant ($p=0.034$).

Conclusion

The Cape Town Metro West health system features a functional maternity referral system. Midwives perform well in referring pregnant women who meet the criteria for high risk. There has been an increase in the number of women referred to the MMH over the study period but in this study group all referrals were found to be appropriate and were compliant with relevant obstetric management protocols. It appears there have not been large shifts in the demographics of referred women over the period reviewed. In addition, the change in the referral pathway has seen Southern Peninsula and Retreat referring to MMH but Khayelitsha no longer referring there. Furthermore, there are emerging risk factors that reflect the epidemiological changes currently being observed in the Cape Town Metro West region.

Chapter one: Introduction to the study

1.1 Introduction

Despite vast improvements in maternal care, many women are still dying due to complications associated with pregnancy and child birth, hence maternal and neonatal health remains a global priority (World Health Organisation [WHO], 2015). For example, in 2013, an estimated 289 000 women died worldwide, which translates to about 800 pregnancy-related deaths every day. The majority of these deaths occur in low and middle income countries (WHO, 2014:15). For example, in Malawi the maternal mortality ratio (MMR) was 510 per 100 000 live births in 2013. Likewise, in Zimbabwe, it was 470 per 100 000 live births in the same year (WHO, 2014). There is an agreement between all United Nations member states, including South Africa, to significantly improve maternal and neonatal health. This is exemplified by the 2015 targets that had been set by Millennium Development Goal 4 (MDG 4) to reduce child (under 5 years) mortality and MDG 5, to reduce maternal mortality ratio and provide universal access to reproductive health care (WHO, 2015). Subsequently, a set of Sustainable Development Goals (SDGs) has been developed internationally as successor framework to MDGs to be met by 2030 and SDG 3 aims to ensure healthy lives and promote well-being for all at all ages. Targets include reducing the global maternal mortality ratio to less than 70 per 100,000 live births, ending preventable deaths of newborns and under 5 children and ensuring universal access to sexual and reproductive health care services (International Council for Science [ICSU], 2015).

In South Africa, maternal health has been prioritised since 1994 when free healthcare for pregnant women was introduced (DoH 2007:7). Perinatal care is delivered in a tiered system structured on the primary healthcare model, where there are different levels of care within a particular district and referral systems are in place to connect these levels to provide appropriate maternity care and share the patient load. The purpose is to make good quality perinatal services accessible within the community so that women's health outcomes can be improved. Clinics and community health centres (CHCs) cater for low-risk cases, whereas district and regional hospitals manage complicated cases (DoH 2007:9). Clinics, CHCs and district hospitals are designated as level 1 and regional hospitals as level 2. Clinics and CHCs

are staffed by nurses and midwives, and the district hospitals include midwives, nurses, and doctors. For that reason district hospitals should have the capacity to perform assisted deliveries and caesarean sections. To ensure effective, appropriate care it is important that each health facility follows clear management and referral protocols (DoH 2007:13).

Within the Cape Town Metro West Health District there are different levels of perinatal service, which were previously referred to as the Peninsula Maternal and Neonatal Service (PMNS). These services include eight midwife obstetric units (MOUs) and two district hospitals at primary level, two secondary hospitals and a tertiary hospital (Figure1.1).

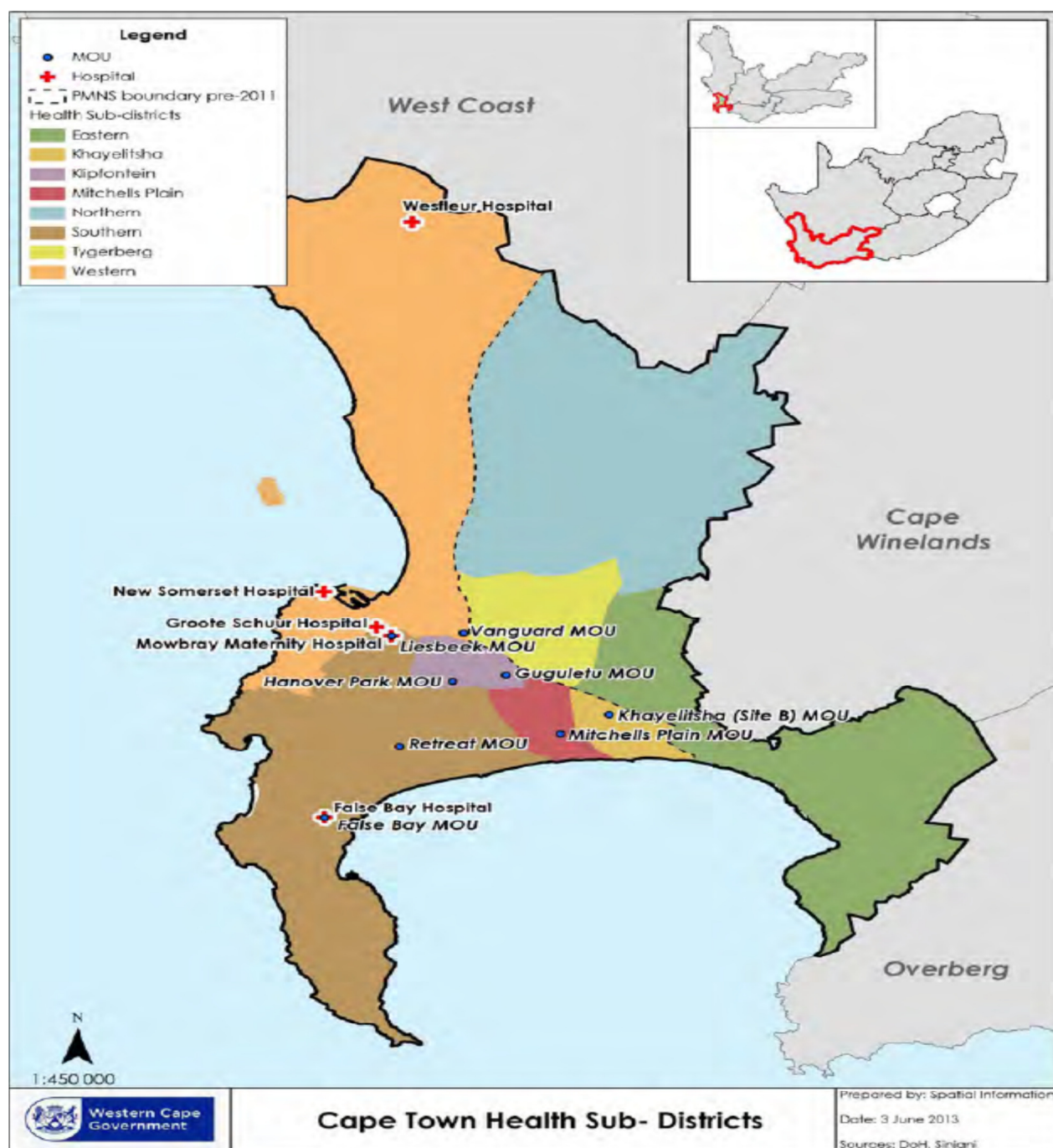


Figure 1.1: Perinatal services in Cape Town Metro West Health District
Source: Western Cape Government cited in Horn (2013:6)

These different levels offer services to cater for women with normal or complicated pregnancies according to local management protocols and referral criteria. The service also includes basic antenatal clinics which are delivered in the community. The risk status of all pregnant women is assessed and, where appropriate, these women may be referred to higher

levels of care according to specific referral criteria. The MOUs offer comprehensive obstetric care for low-risk women. If the pregnant woman has any risk factors, she will be referred to the appropriate referral hospital, either to one of the two secondary hospitals in the district or to the tertiary hospital, or to a 'high risk' clinic at the MOU, whichever is appropriate. This allows for the optimal management of all pregnant women, irrespective of their risk category.

However, over the last few years, there have been some changes in the structure of services, as well as relevant health policy within the Cape Town Metro West health system. In addition, there have been some changes to the referral routes, i.e. changes in how patients from midwife obstetric units are allocated to particular referral hospitals. The effect of these changes in the referral routes on the pattern of deliveries is unknown.

The purpose of this quantitative descriptive study was to assess antenatal and intrapartum referrals at Mowbray Maternity Hospital (MMH) during two different periods, as well as determine whether or not these referrals are appropriate for hospital level delivery.

1.2 Background to the problem

Essential obstetric care (EOC) comprises the fundamental aspects of care required to manage both low-risk and high-risk pregnancies, as well as deliveries and the post-natal period. Maternal mortality and morbidity have been shown to be reduced at facilities that offer these services (WHO, 1991). MMH in Cape Town, South Africa is a secondary referral hospital, providing obstetric and neonatal services for women whose pregnancies have been diagnosed as being high-risk at one of the referring MOUs (MMH, 2014).

According to the Perinatal Problem Identification Programme audit ((PPIP, 2013), MMH has recently been experiencing a continuous increase in the number of deliveries, from around 7500 births in 2005 to close to 11 000 in 2013 (Figure 1.2). In addition, the proportion of deliveries has changed between MOUs and MMH. There has been a decrease from 50% to 35% for total MOU deliveries and an increase from 35% to 45% for MMH deliveries. MMH now manages a greater proportion of total deliveries, which suggests an increase in referrals.

This has created an increased workload and overburdening of hospital resources (Nkyekyer, 2000:815), which affects the quality of obstetric care (Vellem & Tshotsho, 2013:102).

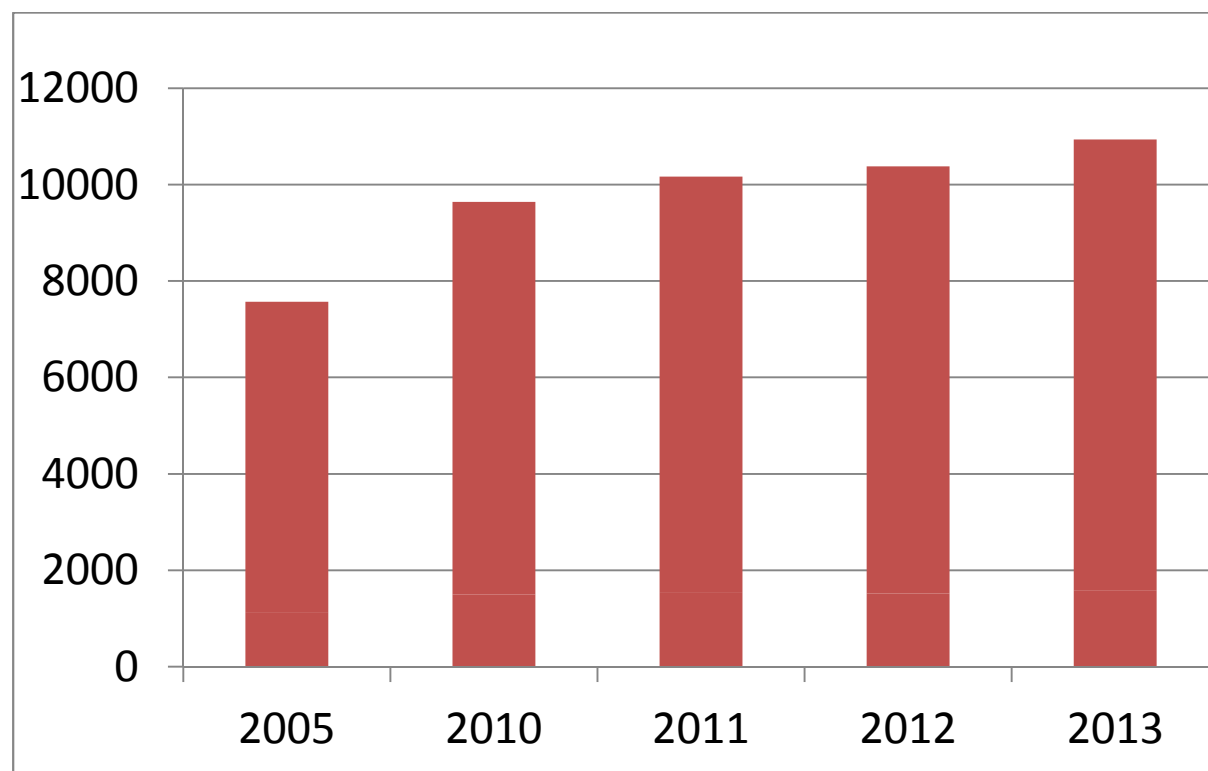


Figure 1.2: The increase in total deliveries of babies at MMH between 2005 and 2013

Source: Adapted from Perinatal Problem Identification Programme (PPIP), 2013

However, to date there have been no studies assessing the changes in the pattern of deliveries at MMH. Therefore, this research aims to describe the antenatal and intrapartum referrals in 2005 and 2013, and assess the changes between the two periods, as well as whether or not these referrals are appropriate for hospital level delivery. This study will improve our understanding of why delivery trends could have changed within the Metro West region over time and whether it is possible to manage these deliveries in a more cost effective manner. This could potentially improve maternal and neonatal outcomes and reduce maternal and neonatal morbidity and mortality.

1.3 Research questions

The study answers the following questions:

1. What are the demographic characteristics of referred women who gave birth at Mowbray Maternity Hospital in the years 2005 and 2013?
2. What are, if any, the changes in their antenatal and labour care and referral pathway?
3. What is the proportion of appropriate and inappropriate referrals at Mowbray Maternity Hospital during 2005 and 2013 and have the proportions changed?

1.4 Research aim

This study aims to describe antenatal and intrapartum referrals for women who gave birth at Mowbray Maternity Hospital in 2005 and 2013.

1.5 Research objectives

1. To describe the demographic characteristics of referred women who delivered at MMH in 2005 and 2013 and assess the changes, if any.
2. To describe the changes in antenatal and labour care and the referral pathway
3. To determine the proportion of appropriate referrals for the MMH level of care and the proportion of inappropriate referrals during 2005 and 2013 and assess the changes, if any.
4. To make recommendations, based on the study results, if this is needed, to reduce the number of patients at MMH.

1.6 Research methodology

A quantitative approach, employing a descriptive design with an analytic component, was used to conduct the study. The study's methodology is described in chapter three.

1.7 Summary

Chapter one: presents a brief introduction to the study, background to the problem, study questions and objectives.

Chapter two: involves a literature review.

Chapter three: covers the research methodology.

Chapter four: presents the results.

Chapter five: presents the discussions and conclusion.

Chapter two: Literature review

2.1 Introduction

A fundamental element of primary healthcare is linking the various levels of care in order to treat patients as close to their homes as possible. At first, every patient should receive appropriate care at primary healthcare level, after which a decision about the need for referral to a more advanced level of care needs to be made. This system is aimed at ensuring the optimum utilisation of primary healthcare and limit unnecessary hospital attendance, as well as providing appropriate care for all people (WHO, 1992:14). The aim of this review is to summarize available literature pertaining to patient referral to higher levels of care in obstetric services. This review has two sections. The first section provides a description of the main requirements for an effective maternity referral system. The second section discusses the factors that contribute to an increase in referrals to higher level facilities.

Sources of information comprise EBSCOHost, PubMed and Google Scholar. This review includes information from published articles dated between 1990 and 2015. However, only a few studies were conducted in the past to assess maternity referrals in South Africa. The following search terms were used: effective maternity referral system, increase referrals, primary health care, secondary obstetric care, low risk pregnancy, high risk pregnancy and referral indications.

2.2 Requirements for an effective maternity referral system

Within healthcare, the referral system denotes a network of services provided to patients across different levels according to their needs (Kang'ethe, 2008:356). The referral system is especially essential during the care of pregnant women and childbirth in order to facilitate emergency obstetric and neonatal care and to serve as back-up to antenatal, intrapartum and postnatal services at primary care level facilities (Jahn & De Brouwere, 2001:225). It is fundamental to reducing maternal and neonatal mortality that the referral system is effective and functions well. In addition, timeous detection and referral to higher levels of care

significantly lowers the neonatal mortality rate associated with complications during childbirth. The referral system is aimed at providing patients with the appropriate level of effective treatment by the right person in a cost effective manner (Murray et al., 2001:353) while avoiding unnecessary delays (Murray & Pearson, 2006:2208).

A successful referral system relies on the efficient functioning of the health system as a whole. (Munjanja, Magure & Kandawasvika, 2012:149). A well-functioning health system, as described by the World Health Organisation, is based on adequately-trained staff, well-maintained infrastructure (including facilities, transportation and communication), a reliable supply of medicines, and technologies, reliable information for evidence-based policies, as well as robust funding (WHO, 2016). This requires health system strengthening by identifying the factors which interfere with service provision and to implement systemic changes in order to deliver quality healthcare to the population, including pregnant women and newborns (Ergo et al., 2011:1-2).

In the literature, there are various requirements for a referral system to function well, including identifying population needs, adequately resourced facilities, designated transport, communications system, trained personnel, agreed setting-specific protocols, record system, monitoring and quality improvement. (Singh et al., 2016:19; Chaturvedi et al., 2014:10; Murray & Pearson, 2006:2206; Dattaray et al., 2013).

2.2.1 Identifying the needs of the population at risk

In order to meet the needs of the population at risk, a referral system requires an understanding of its needs, which is influenced by fluctuating local patterns of disease (Murray & Pearson, 2006:2208). These needs differ between, and within, countries, based on the extent of the maternal and neonatal mortality problem and the relative impact of various causes of death (WHO, 1991:37). For example, in some countries maternal death is mainly due to direct obstetric causes, such as obstructed labour (primarily cephalopelvic disproportion), which is by far the main cause of maternal death in Ethiopia (Berhan & Berhan, 2014:15; Gaym, 2002:11). In Malawi, postpartum haemorrhage is the most

significant cause of maternal death (Ministry of Health of Malawi, 2014:50; Kongnyuy, 2009: 14), while in Latin America and the Caribbean maternal death is mainly due to pregnancy induced hypertension (Say et al., 2014: e328; Khan et al., 2006:1066). On the other hand, in some countries non-obstetric causes are predominant. For instance, Moodley et al. (2014:5) reported in a confidential study on maternal deaths in South Africa that tuberculosis, pneumonia and other opportunistic infections, the majority occurring in HIV-infected women, as being the major cause of maternal deaths. Understanding the cause of maternal mortality is important because specific clinical problems within a region determine how facilities should be planned and managed (WHO, 1991:37).

An assessment of the needs of the population should also take into account socio-economic and cultural factors, as well as beliefs and perceptions that affect access to the referral system and acceptance of referral advice provided by health staff (Nwameme, Phillips & Adongo, 2014:1403; Pembe et al., 2008:120; Essendi, Mills & Fotso, 2011:356), which can negatively impact on the responsiveness of the referral system (Jahn & De Brouwere, 2001:230). Once these barriers are understood, specific interventions can be planned and implemented in order to improve the efficacy of the referral system (Pembe et al., 2008:120). For example, Nwakoby et al. (1997:186) revealed that recruiting community contact persons raised awareness surrounding obstetric services and danger signs during pregnancy. It also improved access to transport, resulting in an easier process to refer patients to hospital. Furthermore, Jokhio, Winter and Cheng, (2005:2091) conducted a controlled trial in a rural district in Pakistan, where communities often prefer traditional birth attendants (TBAs). They found that training traditional birth attendants on identifying complicated cases for referral to hospital resulted in a significant decrease in perinatal mortality and this intervention could result in large improvements in perinatal and maternal health in middle and low income countries.

2.2.2 Adequately resourced facilities, designated transport, communications system and trained personnel

For successful referral, geographical access to referral care facilities is vital as there is usually a geographic distance between the referral centre and the level two health facility. Therefore

a well-functioning transport system is needed to transfer women, especially women in labour, to the next level. Communications systems should make communication between staff at the two facilities possible. Furthermore, adequate numbers of health staff must be trained to ensure that they possess the required skills to provide quality care, particularly emergency care. In addition, essential drugs, supplies, and equipment must be available at health facilities (Cervantes et al., 2003:3; WHO, 2011:8).

The WHO has clearly defined the essential obstetric care skills, including emergency obstetric care (EmOC), and resources required at primary health care level and referral hospitals (Murray et al., 2001:353). The EmOC consist of two levels, namely Basic EmOC (BEmOC) and Comprehensive EmOC (CEmOC). BEmOC include seven signal functions: parenteral administration of antibiotics, parenteral administration of oxytocics, parenteral administration of anticonvulsants, assisted vaginal delivery, manual removal of placenta, manual removal of retained products, and basic neonatal resuscitation. CEmOC include the seven BEmOC signal functions in addition to perform caesarean sections and blood transfusions (WHO, 2009:7).

Fournier et al. (2009:31) reported that obstetric service coverage had been improved and maternal mortality reduced significantly after providing an adequate number of trained staff, equipment essential to BEmOC and CEmOC, as well as radio communication and ambulance transportation between primary health facilities and district hospitals.

Tayler-Smith, (2013:998) revealed similar trends in Burundi where the implementation of effective communication and ambulance systems improved access to emergency obstetric and neonatal care, increasing coverage of complicated obstetric cases by 80% and caesarean sections by 92%. In addition, timeliness of transfer led to a decrease in the risk of maternal and early neonatal deaths, as well as stillbirths.

Similarly, in the Free State Province in South Africa, the implementation of effective and rapid inter-facility transport of women with pregnancy complications, the MMR dropped from 279.4 to 152.8 (per 100 000 live births) from 2011 to 2012 (Schoon, 2013:534).

Likewise, in Angola, Strand et al. (2009:76) found that the maternal mortality dropped from 18% to zero and the coverage of caesarean section increased in Luanda, after nine midwife-run birth units were properly equipped, staff training programmes were implemented and radio communication and ambulance systems established, owing to significantly reduced waiting times.

Furthermore, adequate staff training in rural Rajasthan, India, has been shown to dramatically improve access to skilled maternal and neonatal care in rural areas allowing for the proper management of complicated cases, whether or not referral is required. The progression of certain complications can be reversed when appropriate care is provided by nurse-midwives, thereby avoiding referral. For example, among 41 women with post-partum haemorrhage, only nine patients were referred due to the adequate management of labour (Iyengar, Sharad & Iyengar 2009:14).

2.2.3 Agreed setting-specific protocols and record system

Another requirement for establishing an effective referral system is implementing agreed protocols in health facilities. Health staff, especially at primary level, require protocols to provide guidance on which cases, and at which point, should be referred to a higher level of care. These guidelines may vary according to local epidemiological circumstances and organisational capacity. The partogram is a recommended tool to assess labour progress, as well as maternal and fetal condition, and has been implemented as a routine practice in many countries (Murray et al., 2006:2210). De Groof et al. (1995: 321) revealed that the introduction of the partogram in Niamey, Niger, contributed to a significant reduction in maternal and neonatal mortality, owing to improved follow-up care, timeous decision making and prompt referral to a higher level of care. Similar findings were reported in a recent study in India (Manjulatha & Sravanthi, 2015:214).

Implementing management protocols is very important in order to deal with emergency cases. For example, Dumonta et al. (2005:1264) showed that after emergency obstetric guidelines were implemented, and monitored, at a community hospital in Senegal, there was an increase in the diagnosis of morbidity, a 53% decrease in case fatality and an improvement in maternal outcomes.

In addition to the implementation of protocols, good documentation and record keeping is essential for the collection of suitable data to inform policies that improve maternal and neonatal health. This can be achieved through staff training and motivation (Murray et al., 2001:360).

2.2.4 Monitoring and quality improvement

Reliable baseline information enables monitoring of the referral system in order to identify shortcomings. It is vital to monitor the effectiveness of the referral system and to continuously adapt resources allocation in terms of staff, training, equipment and other aspects, in order to provide a good quality of care (Jahn & De Brouwere 2001:237). By using specific indicators, district management teams can develop their own systems to monitor resource availability, as well as emergency skills, communication and transportation (Murray & Pearson, 2006:2211). Murray et al. (2001:353) identified useful indicators for five aspects in the maternity referral system to monitor its effectiveness in Lusaka, Zambia:

- The population coverage of obstetric services and the birth distribution across facility level.
- The utilisation of emergency obstetric care level facilities in complicated cases (including the antenatal and intrapartum referral rates, reason of referral.
- Caesarean section rate, as well as the met need for emergency obstetric care).
- The inappropriate use of comprehensive emergency obstetric care level (self-referrals without complications).
- The progression towards maternal mortality reduction at referral level (case fatality rate and maternal mortality reviews) and perinatal outcomes (intrapartum still births and Apgar scores).

Establishing an audit system is very useful to monitor and improve the effectiveness of the referral system. In Malawi, implementing a criteria-based audit has been shown to significantly improve a district referral system's capacity to deal with obstetric emergencies (Kongnyuy, Mlava & van den Broek, 2008:1). Firstly, referral system standards were established for the Salima District and then current practice was measured by reviewing all women who were referred with complications. Current practice was then compared to these standards. The results identified particular shortcomings, which were corrected by implementing particular recommendations. The audit was repeated after three months to assess whether progress was made. Further recommendations followed and the cycle repeated (Kongnyuy, Mlava & van den Broek, 2008:3).

Similarly, using a clinic-based audit improved the quality of care of women who were referred with obstetric emergencies in Angola. Base-line information was collected during two periods and compared. Sub-standard practices were identified for improvement. (Strand et al., 2009:76).

2.3 Factors contributing to an increase in referrals

The efficacy of the referral system could be hampered by the overutilization of higher level care facilities owing to an increase in referrals from lower level facilities. Little attention has been given to the overutilization of higher level facilities, despite its important implications in terms of cost and quality of care, especially in resource-limited settings (Van Lerberge et al., 1997 cited in Murray et al., 2001:353). Factors that contribute to an increase in referrals at high level facilities include patients bypassing the primary health care level, dysfunctional maternity referral systems and an increase in pregnancy- and labour-related complications.

2.3.1 Patient bypassing of the primary health care level

In many developing countries patients' bypassing the primary level of care is a widespread phenomenon, particularly with pregnant women directly seeking hospital level care. In western Tanzania, Kruk et al. (2009: 279) found that approximately 44% of women who recently gave birth in a health facility delivered their babies at government hospitals or

mission facilities, instead of at the nearest clinics. This occurred in spite of many obstacles, such as long travelling distances to hospital and extra costs for medication and transportation. Similarly, a study conducted in the Kisumu municipality in Kenya explored the under-utilisation of municipal health facilities for maternal and child health services and found a rate of bypassing ranging from 46.3% to 59.5% (Audo, Ferguson & Njoroge 2005:547).

Both studies indicated that the perceived quality of primary care facilities significantly affected decision making in this regard. In South Africa, Vellem and Tshotsho (2013:101) found that self-referred pregnant women in the Eastern Cape bypassed the midwife obstetric units due to being unaware of their service and operation modes. There was also a perception of poor quality of care, including negative attitudes from staff. In addition, self-referral was shown to be closely linked to proximity to the hospital (Cecilia Makiwane Hospital). However, this study did not provide data on the proportion of self-referrals and referrals by health staff in order to assess the extent of bypassing of primary health care services.

In an exit survey at MMH, Fawcus, et al. (2003:634) discovered that only 42% of hospital patients had always lived in the Western Cape, 53% originated from the Eastern Cape, with 13% having resided in the Western Cape for less than a year. Inadequate health facilities in the original residence were given as one of the main reasons for bypassing behaviour. However, this study only emphasized patients' province of origin and didn't provide information on patient demographics, antenatal care, reasons for referral or their risk profile to measure to what extent the utilisation of MMH services was appropriate.

2.3.2 Dysfunction of maternity referral services at sending facilities

Another factor that contributes to an increase in referrals at hospital level is the dysfunction of maternity referral services. The malfunctioning of maternity referral services such as staff incompetence and shortages hampers efficient management of maternity care, resulting in increased referrals to higher level facilities.

For example, a study by Chaturvedil et al. (2014:e96773) in Madhya Pradesh province in India showed that 40% of referrals from community health facilities (the secondary level of health care) involved prolonged labour, which was expected to have been managed at this level. This is mainly due to the health workers' inability to provide even basic emergency obstetric management at secondary level. This resulted in adverse birth outcomes and high maternal mortality. Furthermore, some cases were referred due to insufficient staff, as well as electricity and water shortages – which also affect primary health facilities.

Similarly, a study conducted by Nkyekeyer (2000:811) in Ghana showed an increase of 47.4% in the maternity workload at hospital level, with the number of actual deliveries far exceeding what was expected. Most referrals originated from primary health facilities (including private midwives) and the most common indications were failure to progress and hypertensive disease. However, some of these referrals could have been avoided and managed at the sending facility without the need for referral. For instance, 37.6% of patients who were referred on account of failure to progress still had intact membranes. Artificially rupturing the membranes at the appropriate time may have been sufficient to induce labour successfully, without the need for referral. Also, the study explored the significant deficiencies in the referral mechanism. For example the staff did not provide adequate details regarding the progress of labour, with very few patients accompanied by partographs. This could either indicate that partographs are not widely used at sending facilities or that staff deem their inclusion unnecessary when referring patients.

A study performed in Tshwane, South Africa, by Horner and Mashamba (2014:133) revealed that there were gaps in the referral services at midwife obstetric units in Tshwane North sub-district, with data indicating that 21.2% of high risk patients delivered at the midwife obstetric units, instead of delivering at hospital level.

Similarly, Majoko et al. (2005:656), indicated that there was a high rate of non-compliance with referral criteria at health centres in Gutu district in Zimbabwe, where midwives did not refer 59% of women with previous complications and 52% of women with raised blood

pressure. These examples constitute risks for these women who were supposed to deliver at hospital level. This needs implementing strict referral and non-referral protocols.

2.3.3 Patient obstetric history and pregnancy related complications

The change in the prevalence of risk factors among pregnant women that need to be referred to high level facilities constitutes a significant reason for the increase in referrals and hospital deliveries. Amelink-Verburg et al. (2009:928) conducted a study in the Netherlands which highlighted three main reasons for the continuous increase in the referral rate between 1988 and 2004 from midwife-led care to hospital level delivery. Firstly, obstetric history, particularly previous caesarean sections, accounted for 38% in the increase in referrals. Secondly, a rise in referrals for meconium-stained amniotic fluid accounted for up to 27% of the increase. Finally, 25% of the referral increase was due to more nulliparous women (i.e. who have not given birth before) demanding pain relief. Furthermore, this study revealed that a change in maternal characteristics, such as age and ethnicity, is likely to have had an important influence on the changing referral rate. Also, a study by Offerhaus et al. (2013:195) conducted in the Netherlands revealed that the consistent rise in referrals during labour between 2000 and 2008 was due to lack of progress of labour, meconium-stained amniotic fluid and demands for pain relief. These were classified as “non-urgent”, because there were no other signs of foetal distress. However, in this study, changes in maternal characteristics did not explain the continuous rise in maternity referrals from primary midwife-led care.

In a study in Tanzania, Pembe et al. (2010:1) found that up to 70% of referrals from primary level of care to hospital level were due to maternal age being below 20 years, as well as having five or more pregnancies. However, this study didn't reflect an increase in referrals; rather, these are common risk factors in sub-Saharan Africa. Likewise, in Zimbabwe, Majoko et al. (2005:656) showed that maternal age below 20 years was a common indication for referral. In addition, Strand et al, 2009:79 reported prolonged labour to be the most common reason for referral in Angola.

2.4 Conclusion

This chapter reviewed the literature on the main requirements for effective referral system, including identifying population needs, adequately resourced facilities, designated transport, communications system, trained personnel, agreed setting-specific protocols, record system, monitoring and quality improvement. In addition, this review emphasized some factors that contribute to an increase in referrals and the overutilization of higher level facilities. Most of the literature from low and middle income countries highlights concerns regarding the quality of care and a lack of clear referral policies. It has been shown that primary care facilities presently do not meet maternal health requirements and are bypassed in spite of their widespread availability. That results in an overburdening of services at higher level facilities. Furthermore, patient obstetric history and pregnancy-related complications are considered significant reasons for rising referral rates.

In South Africa few studies assess maternity referrals. To our knowledge, there have been no published studies conducted at MMH investigating changes in the pattern of deliveries and referrals. Hence, this study attempts to assess antenatal and intrapartum referrals and evaluate whether obstetric referrals are appropriate.

Chapter three: Research methodology

3.1 Introduction

This chapter describes the research methodology including the study design, study setting, study population, and sampling method. It also describes the data collection method and data analysis. Furthermore, validity, reliability and generalizability, as well as the risk and benefits of the study, are discussed. In addition, ethical considerations are also highlighted.

3.2 Study design

This research employed a quantitative method and a descriptive design, with an analytic component. A retrospective review of hospital folders was conducted for referred women who delivered at MMH from January to December 2005 and from January to December 2013. This design is appropriate as it allows the researcher to assess and compare the characteristics of referrals between the two periods (Morrone & Myer, 2007:85).

3.3 Study setting

The study was conducted at MMH in Cape Town Metro West, South Africa. According to the 2011 census, the City of Cape Town as a whole had a population of 3 740 025, which was an increase of about 29% since 2001 (City of Cape Town Census, 2011). The Cape Town Metro West district is served by midwife obstetric units in Retreat, Hanover Park, Vanguard, Gugulethu, Khayelitsha, Mitchell's Plain, False Bay and Liesbeeck. Furthermore, the primary hospitals are False Bay Hospital and Wesfleur Hospital. The secondary hospitals are MMH and New Somerset Hospital (NSH), and the tertiary hospital is Groote Schuur Hospital (GSH). (Western Cape Government, 2013 cited in Horn, 2013:6)

MMH offers obstetric services with the availability of 106 beds, as well as neonatal services with 74 beds. The hospital's staff consists of a team of highly experienced and trained midwives and obstetricians. As a referral hospital, MMH currently caters for referrals from Midwife Obstetric Units in Liesbeeck, Hanover Park, Mitchells Plain, Gugulethu and Retreat

(MMH, 2014). However, in 2005 (prior to a change in the referral route) MMH was receiving referrals from the Gugulethu, Khayelitsha, Mitchells Plain and Liesbeeck MOUs, while, in 2013 (following another change in the referral route), the hospital was receiving referrals from the Gugulethu, Mitchells Plain, Retreat and Liesbeeck MOUs as well as False Bay Hospital. Cases that need tertiary care are referred directly to GSH.

3.4 Study population

The study population consisted of referred women who, according to hospital records, delivered at MMH during 2005 and 2013, from 1st January to 31st December.

3.4.1 Inclusion and exclusion criteria

Inclusion criteria:

- The folders of women who were referred during the antenatal period and, due to risk factors, planned to deliver at MMH.
- The folders of women who were referred during labour owing to complications.

Exclusion criteria:

- The folders of women who delivered elsewhere but who were referred due to postpartum complications.
- The folders of low risk patients at the Liesbeeck section of the hospital (which is considered a primary level care facility for patients residing within the catchment area) who were not included in the increase in deliveries recorded in the PPIP audit (2013). Records of both low risk and high risk cases are kept in one location at the hospital, even though the actual low and high risk maternity sections operate completely separately.

3.5 Sampling

The sampling frame comprised folders of all deliveries at MMH during 2005 and 2013, from 1st January to 31st December. A sample size of 138 folders for 2005, and 246 folders for

2013, is required to obtain a 95% confidence index with 5% precision. This is assuming that the percentage of low risk patients referred to MMH in 2005 and 2013 was 10% and 20%, respectively.

A systematic random sampling strategy was used for sample selection, which is especially appropriate when using patient records (Joubert & Katzenellenbogen, 2007:100). Random sampling ensures a representative sample of the population with various population units having an equal chance of being chosen (Joubert & Katzenellenbogen, 2007:95). This would minimise sampling bias and ensure study validity (Myer & Abdool Karim, 2007:161).

The first step was to establish the sampling interval, by dividing the total number of deliveries in 2005 and 2013 by the number of cases in the sample size. The sampling interval was 55 for 2005 and 45 for 2013. Then, folders were selected from a random starting point at every 55th for 2005 and every 45th folder for 2013 systematically, until the sample size was achieved. The twenty folders that were missing antenatal and delivery notes were replaced during a second round of selection, by selecting, as before, from a random starting point at every 55th and 45th folders for 2005 and 2013 respectively.

3.6 Data collection

Data was collected by using hospital records that is patient folders. Hospital records as a documentary source are inexpensive and relatively quick as they are easily accessible. This was ideal as study time and financial resources were limited. It also allowed historical comparison of referrals (Katzenellenbogen & Joubert 2007:108).

3.6.1 Data collection tool

The patient folders reviewed and the required variables for the study extracted and captured on a data collection sheet (appendix 1). The data collection sheet contains three sections:

Section A: relates to the socio-demographic characteristics including age, marital status, employment status, race, area of residence and nationality.

Section B: is related to the antenatal and labour care and referral pathway. It included parity, gravidity, which antenatal clinic they attended, gestational age at 1st ANC visit, number of ANC visits, mode of delivery, source of referral and category of referral (whether antenatal or intrapartum referrals).

Section C: is related to the appropriateness of referrals: Appropriate to deliver at MMH refers to pregnancies that were high risk at the time of referral. Inappropriate to deliver at MMH refers to pregnancies that were low risk at the time of referral according to the local protocols regarding referral criteria for clinical practice at level 1 maternity care facilities in the Metro West, 2011(Appendix 2) and 2005 (Appendix 3).

This section includes the predominant reason for referral and patients' risk category (low risk or high risk pregnancies). It also lists all risk factors experienced by the referred women including the risk factors that were reasons for referral, the risk factors that developed after patients were referred, as well as other risk factors that are not a reason for referral, such as tobacco and alcohol use, successfully treated anaemia and HIV. These risk factors are categorised as antenatal and intrapartum risk factors.

All risk factors were taken from antenatal care notes and delivery notes made by midwives and doctors. However, obesity and morbid obesity risk factors were not indicated in most folders in 2005. In 2013 the obesity measurement was based on measuring the mid-upper arm circumference (MUAC). In order to identify these risk factors and make a possible comparison between the two periods, body mass index (BMI) was calculated for all patients: weight (kg) divided by height (m) squared. According to the WHO definition, obese patients have a BMI of 30-39 and morbidly obese patients have a BMI of greater than 40 (Western Cape Government, 2011:5).

It is important to note that, according to clinical practice protocols, pregnant women who intend to give up their babies for adoption are also referred to a higher level of care, irrespective of their medical risk category.

3.7 Data analysis

Collected data was checked for missing or incorrect information. Data was entered into a Microsoft Excel spread sheet and analysed using STATA version 12. Graphical display and frequency tables were used to explore the data in order to detect errors, examine patterns and to determine appropriate method of statistical analysis (Joubert, 2007:129). Descriptive statistics were applied in this study. The central tendency was measured by determining mean, and standard deviation (SD) to summarize numerical variables such as age, parity and gravidity, gestational age at first ANC visit and number of ANC visits. The mean was used for normally distributed data. However, when the distribution was asymmetrical or skewed the median and inter quartile range (IQR) were used instead to describe the central tendency (Joubert, 2007:137). Frequency counts and proportions, where appropriate, were used to summarize categorical variables such as marital status, employment status, race, mode of delivery, source of referral, reason of referral, risk category and antenatal and intra-partum risk factors.

The Welch Two Sample t-test was used to compare normally distributed numerical variables, while the Wilcoxon rank sum (non-parametric test) was applied to compare asymmetrically distributed numerical variables. The Pearson's Chi-squared test was used to compare categorical variables of referrals between 2005 and 2013. Statistical significance was accepted at a *P*-value less than 0.05 for all statistical tests (Joubert, 2007:146).

3.8 Pilot study

A pilot study was conducted before commencing the main study to evaluate the reliability of the data collection sheet. It examined a sample of 10 folders from 2005 and 2013 to test the data collection sheet and modifications were made (Katzenellenbogen & Joubert 2007:116).

3.9 Presentation of results

The findings of this study are presented in chapter four using descriptive tables.

3.10 Reliability and validity

Reliability denotes the extent to which findings are similar when the same subject is measured repeatedly (Joubert & Katzenellenbogen, 2007:117). As previously mentioned, the data collection sheet was tested and adjusted, which ensured that the data collected, and data sheet, were reliable. (Myer & Abdool Karim, 2007:159).

Validity refers to the degree to which a study's finding reflects the truth, without being biased or being compromised by confounding variables (Myer & Abdool Karim, 2007:156; Joubert & Katzenellenbogen, 2007:117). Although the selection of a representative sample minimised sampling bias (Myer & Abdool Karim, 2007:161), the validity of the study may have been affected by the illegible handwriting, as well some folders missing some data. Some risk factors, therefore, could be underestimated. Also, since 2005, there had been a change in the antenatal document design. In 2005, only smoking habits were recorded on the antenatal card, whereas the new antenatal booklet used in 2013 records alcohol and drugs consumption, in addition to smoking habits. In addition, there could also be an underestimation of substance abuse as a risk factor, as it was not disclosed by some patients during antenatal visits, but only discovered after being admitted for complications at MMH.

3.11 Generalizability

The generalizability refers to the extent to which the research conclusions would be applicable to other people, places and periods – also known as “transferability” (Polit & Beck, 2010:1453, Trochim, 2006). Furthermore, the generalizability also denotes the ability to apply the findings of the sample study to the entire study population, also known as “statistical generalization” (Polit & Beck, 2010:1452: Trochim, 2006).

Using the theory of proximal similarity (Polit & Beck, 2010:1453, Trochim, 2006), this study investigated a diverse representation of the population who utilize secondary maternal health facilities within the Metro West region. Therefore, the findings of this study could be generalizable to other metropolitan regional hospitals in South Africa, provided that the similar management protocols and referral criteria are used. In addition, given that the sample was representative, its findings would be generalizable to the entire study population.

3.12 Risks and benefits of the study

There are no risks attached to this study, as it is based on hospital folders, not patients.

This study will prove very useful for the patients, staff and administration at Mowbray Maternity Hospital, as well as for the Provincial Administration of the Western Cape in general, as its findings could be applied to improve the delivery of obstetric services, influence health policy planning and as a basis for future research.

3.13 Ethical considerations

Ethical approval was obtained from the University of Cape Town Faculty of Health Sciences Human research ethics committee (appendix 4) and Mowbray Maternity Hospital authorities gave permission to conduct the research. As patient data is routinely collected, individual patient consent was not explicitly required. Confidentiality was ensured according to the Helsinki declaration (World Medical Association, 2013:E2) by entering the extracted data into a password protected database. The information was anonymised so that the identity of individual patients was not known. In addition, only individuals directly involved in conducting the study accessed to the data.

Chapter four: Results

4.1 Introduction

This chapter presents the results section of the study that assessed antenatal and intrapartum referrals at MMH in 2005 and 2013. It presents the socio-demographic profile, antenatal and labour care and referral pathway as well as the appropriateness of referrals of pregnant women.

4.2 Socio-demographic characteristics

4. 2. 1 Maternal age

In the sample of 138 referred women who delivered at MMH in 2005, the mean age was 27.259 (SD \pm 6.277) years. In 2013, the mean age in the sample of 246 women was 27.326 (SD \pm 6.025) years (Table 4.1). Table 4.1 also shows the age distribution of referred women in 2005 and 2013, with more than half of women in their 20's. The Welch Two Sample t-test showed no significant statistical difference in the mean age between referrals in 2005 and 2013 ($p= 0.918$). The Pearson's Chi-squared test showed no significant statistical difference in the proportion of age category between referrals in the two periods ($p=0.919$).

Table 4.1: Mean age and age categories of women who delivered at MMH in 2005 and 2013

Mean age	2005	2013	<i>p</i> -value
Mean	27.259	27.326	0.918
SD	6.277	6.025	
Age category	Number (n) and percentage (%)		0.919
	2005	2013	
< 15	1 (0.7%)	0	
15-19	16 (11.6%)	30 (12.2%)	
20-24	37 (26.8%)	64 (26%)	
25-29	40 (29%)	72 (29.3%)	
30-34	27 (19.6%)	48 (19.5%)	
35-39	16 (11.6%)	28 (11.4%)	
40-44	1 (0.7%)	3 (1.2%)	
45-49	0	1 (0.4%)	

4.2.2 Marital status

The marital status for women who delivered at MMH in 2005 was indicated in 128 folders. Approximately half, (52.2 %) of patients were single, 39.1% were married and 1.4% were divorced. In 2013, more than two thirds (72.4%) of women were single, 26.4% were married and 1.2% were divorced (Table 4.2). Pearson's Chi-squared test showed a significant statistical difference in the proportion of marital status of the referred women during the two periods ($p < 0.001$).

Table 4.2: Marital status of women who delivered at MMH in 2005 and 2013

Marital status	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	< 0.001
Single	72 (52.2%)	178 (72.4%)	
Married	54 (39.1%)	65 (26.4%)	
Divorced	2 (1.4%)	3 (1.2%)	
Not indicated	10 (7.2%)	0	

4.2.3 Employment status

In 2005, the employment status was indicated in 133 folders. More than half (54.3%) of the women were unemployed and 75 (33.3%) were employed. In 2013 the employment status was indicated in 241 folders. Slightly more than two thirds (69.9%) of women were unemployed and 28% of women were employed (Table 4.3). The Pearson's Chi-squared test showed a significant statistical difference in the proportion of employment status of referred women in 2005 and 2013 ($p < 0.001$).

Table 4.3: Employment status of women who delivered at MMH in 2005 and 2013

Employment status	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Employed	46 (33.3%)	69 (28%)	< 0.001
Unemployed	75 (54.3 %)	172 (69.9%)	
Not indicated	17 (12.3%)	5 (2%)	

4.2.4 Race

In 2005, 95 (68.8%) women were black and 43 (31.2%) were coloured. In 2013, 142 (57.7%) women were black, 101 (41.1%) were coloured and 3 (1.2%) women were white (Table 4.4). The Pearson's Chi-squared test showed no significant statistical difference in the proportion of race between referred women in 2005 and 2013 ($P=0.056$).

Table 4.4: Race of women who delivered at MMH in 2005 and 2013

Race	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Black	95 (68.8%)	142 (57.7%)	0.056
Coloured	43 (31.2%)	101 (41.1%)	
White	0	3 (1.2%)	

4.2.5 Area of residence

Table 4.5 represents the area of residence for women who delivered at MMH in 2005 and 2013. In 2005, most women in the sample resided in Mitchell's Plain 45 (32.6%), Gugulethu 39 (28.3%) or Khayelitsha 38 (27.5%). In 2013, most women in the sample resided in Mitchell's plain 83 (33.7%), Gugulethu 60 (24.4%) and Retreat 48 (19.5%). The Pearson's

Chi-squared test showed a significant statistical difference in the proportion of area of residence of referred women in 2005 and 2013 ($p = 0.001$).

Table 4.5: Area of residence of women who delivered at MMH in 2005 and 2013

Area of residence	Number (n) and percentage (%)		p -value
	2005	2013	0.001
Mitchell's Plain	45 (32.6%)	83 (33.7%)	
Gugulethu	39 (28.3%)	60 (24.4%)	
Khayelitsha	38 (27.5%)	3 (1.2%)	
Retreat	0	48 (19.5%)	
Southern Peninsula	1	31 (12.6%)	
Others	15 (10%)	18 (6%)	

The others category includes Woodstock, Mowbray, Rondebosch, Salt River, Kenilworth, Tableview, Observatory, Pinelands, Athlone, Kraaifontein, Bayview, Ikewzipark, Hanover Park and Eastern Cape.

4.2.6 Nationality

The nationality of women who delivered at MMH in 2005 and 2013 is represented in Table 4.6. It shows that in both 2005 and 2013, most women in the sample were South African, at 98.6% and 89% respectively. In 2005, only two women were foreigners and in 2013, 27 women were from other African countries. The Pearson's Chi-squared test shows no significant statistical difference between referrals' nationality in 2005 and 2013 ($p=0.108$).

Table 4.6: Nationality of women who delivered at MMH in 2005 and 2013

Nationality	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	0.108
South African	136 (98.6%)	219 (89%)	
Zimbabwean	1 (0.7%)	8 (3.3%)	
Malawian	0	7 (2.8%)	
Congolese	0	3 (1.2%)	
Zambian	0	2 (0.8%)	
Ugandan	0	2 (0.8%)	
Angolan	0	1 (0.4%)	
Rwandan	0	1 (0.4%)	
Somali	0	1 (0.4%)	
Mozambican	1 (0.7%)	0	
Others	0	2 (0.8%)	

4.3 Antenatal and labour care and referral pathway

4.3.1 Parity and gravidity

The median parity for referred women in the 2005 sample was 1 (IQR: from 0 to 2). In 2013 the median parity was 1 (IQR: from 0 to 1). The median gravidity in 2005 and 2013 was 2 (IQR: from 1 to 3) (Table 4.7). Wilcoxon rank sum test showed a significant statistical difference in the mean parity and gravidity of referred women in both periods, at *p*-value of 0.029 and 0.042 respectively.

Table 4.7: Parity and gravidity of women who delivered at MMH in 2005 and 2013

Parity	2005	2013	<i>p</i> -value
Median	1	1	0.029
IQR	0 - 2	0 - 1	
Gravidity			
Median	2	2	0.042
IQR	1 - 3	1 - 3	

Table 4.8 shows the parity and gravidity categories for the sample of referred women in 2005 and 2013 with the majority of women having a parity of less than 2. The gravidity categories indicate that a significant number of women in the sample were in their first, second or third pregnancies in 2005, whereas in 2013 first and second pregnancies were the most predominant. The Pearson's Chi-squared test shows no significant statistical difference in the proportion of parity category between referrals in 2005 and 2013 ($p=0.216$). Also, there is no significant statistical difference in the proportion of gravidity category between referrals in 2005 and 2013 ($P=0.227$).

Table 4.8: Parity and gravidity categories of women who delivered at MMH in 2005 and 2013

Parity category	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	0.216
0	47 (34.1%)	101 (41.5%)	
1	43 (31.2%)	85 (34.6%)	
2	24 (17.4%)	34 (13.8%)	
3	14 (10.1%)	16 (6.5%)	
4	7 (5.1%)	5 (2%)	
5	1 (0.7%)	2 (1.1.2%)	
6	0	1 (0.4%)	
7	1 (0.7%)	0	
8	1 (0.7%)	0	
Gravidity category			0.227
1	42 (30.4%)	87 (35.4%)	
2	39 (28.3%)	85 (34.6%)	
3	28 (20.3%)	43 (17.5%)	
4	16 (11.6%)	19 (7.7%)	
5	9 (6.5%)	7 (2.8%)	
6	2 (1.4%)	1 (1.6%)	
7	0	1 (0.4%)	
8	1 (0.7%)	0	
11	1 (0.7%)	0	

4.3.2 Booking status

Most women in the two samples were booked at antenatal clinics, with only 8 (5.8%) and 12 (4.9%) unbooked in 2005 and 2013, respectively (Table 4.9). The Pearson's Chi-squared test shows no significant statistical difference in the proportion of booking status of referrals in 2005 and 2013 ($p=0.697$).

Table 4.9: Booking status of women who delivered at MMH in 2005 and 2013

Booked at antenatal clinic	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Yes	130 (94.2%)	234 (95.1%)	0.697
No	8 (5.8%)	12 (4.9%)	

4.3.3 Antenatal clinic attended

In 2005, most booked women attended antenatal clinics at Mitchell's Plain MOU 42 (30.4%), Gugulethu MOU 38 (27.5%) and Khayelitsha MOU 35(25.4%). In 2013, most booked women attended antenatal clinic at Mitchells plain MOU 83 (33.7%), Retreat MOU 48 (19.5%) and Gugulethu MOU 56 (22.7%) (Table 4.10). The Pearson's Chi-squared test showed a significant statistical difference in antenatal clinic attended by referrals in 2005 and 2013 ($p < 0.001$).

Table 4.10: Antenatal clinics attended by women who delivered at MMH in 2005 and 2013

Antenatal clinic attended	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Mitchell's Plain MOU	42 (30.4%)	83 (33.7%)	< 0.001
Gugulethu MOU	38 (27.5%)	56 (22.7%)	
Khayelitsha MOU	35 (25.4%)	0	
Retreat MOU	0	48 (19.5%)	
False Bay hospital	0	24 (9.7%)	
MMH	14 (10.1%)	18 (7.3%)	
GSH	1 (0.7%)	0	
Nil	8 (5.8%)	12 (4.9%)	
Others*	0	3 (1.2%)	

Others*: Vuyani clinic, Phumlani clinic and Albowgardens CHC

4.3.4 Gestational age at first ANC visit

In 2005, the gestational age at first ANC visit was recorded in 121 folders. For 9 patients, their gestational age at first ANC visit was not indicated in their folders and 8 patients were unbooked. The median gestational age at first ANC visit was 24 (IQR: from 19 to 28) weeks. In 2013, the gestational age at first ANC visit was recorded in 228 folders. For 6 patients, their gestational age at first ANC visit was not indicated in their folders and 12 patients were unbooked. The median gestational age was 19 (IQR: from 15 to 25) weeks (Table 4.11). The Wilcoxon rank sum test showed a significant statistical difference in mean gestational age at first ANC visit for referrals in 2005 and 2013 ($p < 0.001$).

4.3.5 Number of ANC visits

In 2005, the number of ANC visits was indicated in 129 folders. Eight women were unbooked and one woman's folder was missing some antenatal notes. The median was 5 (IQR: from 4 to 7) visits. In 2013, the number of ANC visits was indicated in 234 folders and 12 women were unbooked. The median was 6 (IQR: from 5 to 8) visits (Table 4.11). The Wilcoxon rank sum test showed a significant statistical difference in the mean number of ANC visits for referrals in 2005 and 2013 ($p = 0.013$).

Table 4.11: Gestational age at first ANC visit and number of ANC visits by year

Gestational age at first ANC visit	2005	2013	<i>p</i> -value
Median	24	19	< 0.001
IQR	19-28	15-25	
Number of ANC visits			
Median	5	6	0.013
IQR	4-7	5-8	

4.3.6 Mode of delivery

In the 2005 sample, 77 (55.8%) referred women had normal vaginal delivery, 56 (40.6%) had caesarean section and 5 (3.6%) had assisted delivery. In the 2013 sample, 125 (50.8%) referrals had normal vaginal delivery, 118 (48%) had caesarean section and 3 (1.2%) had assisted delivery (Table 4.12). The Pearson's Chi-squared test showed no significant statistical difference in the mode of delivery for referrals in the two years ($p=0.139$).

Table 4.12: Mode of delivery by year

Mode of delivery	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Normal vaginal delivery	77 (55.8%)	125 (50.8%)	0.139
Caesarean section	56 (40.6%)	118 (48%)	
Assisted delivery	5 (3.6%)	3 (1.2%)	

4.3.7 Source and category of referral

The majority of women were referred from MOUs in both 2005 and 2013, at 90.6% and 85.45% respectively. In 2005, just under two thirds (65.9%) of patients were referred during the antenatal period and in 2013, just over two thirds (68.3%). Intrapartum referrals were 34.1% for 2005 and 31.7% for 2013 (Table 4.13). The Pearson's Chi-squared test showed a significant statistical difference in the source of referral for referred women in 2005 and 2013 ($p < 0.001$), but there is no significant statistical difference in the category of referral for referred women in 2005 and 2013 ($p=0.637$).

Table 4.13: Source of referral and referral category by year

Source of referral	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	< 0.001
MOU	125 (90.6%)	210 (85.4%)	
public hospitals	1 (0.7%)	26 (10.6%)	
clinic	1 (0.7%)	7 (2.8%)	
Self-referral	11 (8%)	3(1.2%)	
Referral category			0.637
Antenatal referral	91 (65.9%)	168 (68.3%)	
Intrapartum referral	47 (34.1%)	78 (31.1%)	

4.4. Appropriateness of referrals

4.4.1 Reason for referral

Table 4.14 lists the most common reasons for referral in 2005 and 2013, showing that previous caesarean section was the predominant reason in both samples. The “others” category includes less frequent reasons for referral which are listed in table 4.15. The Pearson’s Chi-squared test showed a significant statistical difference in the proportion of reason for referral for women who gave birth at MMH in 2005 and 2013 ($p < 0.001$).

Table 4.14: Common reasons for referral in 2005 and 2013

Reason for referral	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	< 0.001
Previous caesarean section	26 (18.8%)	49 (19.9%)	
Prolonged pregnancy	11 (7.9%)	45 (18.3%)	
Raised blood pressure and/or proteinuria	16 (11.6%)	28 (11.4%)	
Prelabour rupture of membranes	17 (12.3%)	14 (5.7%)	
Failure to progress in active phase of labour	7 (5.1%)	14 (5.7%)	
Preterm labour	6 (4.3%)	10 (4.1%)	
Prolonged latent phase of labour	3 (2.1%)	11 (4.5 %)	
Preterm prelabour rupture of membranes	11 (7.9%)	4 (1.6%)	
Antepartum haemorrhage	3 (2.2%)	7 (2.8%)	
Fetal distress	2 (1.4%)	6 (2.4%)	
Prolonged second stage of labour	2 (1.4%)	6 (2.4%)	
Multiple pregnancy	3 (2.2%)	4 (1.6%)	
Meconium stained amniotic fluid	0	6 (2.4%)	
Anaemia	0	6 (2.4%)	
Decreased fetal movement	0	5 (2%)	
Malpresentation	2 (1.4%)	2 (0.8%)	
Age less than 18 years	4 (2.9%)	0	
Previous neonatal death	0	4 (1.6%)	
5 or more previous deliveries	3 (2.2%)	0	
Asthma	0	3 (1.2%)	
Previous stillbirth	3 (2.2%)	0	
For tubal ligation	2 (1.4%)	0	
Intrauterine growth restriction	0	2 (0.8%)	
Morbid obesity	0	2 (0.8%)	
Oligohydramnios	0	2 (0.8%)	
Others	17 (12.3%)	16 (6.5%)	

Table 4.15: Less frequent reasons for referral

Reason for referral	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Baby for adoption	1(0.7%)	0	< 0.001
Active labour	1(0.7%)	0	
Chronic hypertension	0	1 (0.4%)	
Convulsions	1(0.7%)	0	
Cord prolapse	1 (0.7%)	0	
Epilepsy	1(0.7%)	0	
Lower respiratory tract infection	0	1 (0.4%)	
Large baby	1(0.7%)	0	
Maternal tachycardia	0	1 (0.4%)	
Previous brain tumour and ventriculoperitoneal shunt	0	1 (0.4%)	
Previous eclampsia	0	1 (0.4%)	
Previous gestational diabetes	0	1 (0.4%)	
Previous kidney stones in pregnancy	1(0.7%)	0	
Previous postpartum haemorrhage	0	1 (0.4%)	
Previous two second trimester miscarriage	2(1.4%)	0	
Trauma to the abdomen	1 (0.7%)	1 (0.4%)	
Cardiac disease	1(0.7%)	0	
Age more than 38 years	0	1 (0.4%)	
Vaginal mass	0	1 (0.4%)	
Pyelonephritis	1 (0.7%)	1 (0.4%)	
Fetal anomaly	0	1 (0.4%)	
Previous preterm labour	1 (0.7%)	1 (0.4%)	

4.4.2 Risk category

In the 2005 sample, 135 (97.8%) referred women had high risk pregnancies, whereas in 2013, all referrals (100%) had high risk pregnancies (Table 4.16). The Pearson's Chi-squared test showed a significant statistical difference in the risk categories for referred women in 2005 and 2013 ($p=0.02$).

Table 4.16: Risk category of women who delivered at MMH in 2005 and 2013

Risk category	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
High risk	135(97.8%)	246 (100%)	0.02
Low risk	3 (2.2%)	0	

4.4.3 Antenatal risk factors

Most referred women in the 2005 and in 2013 samples had one or more antenatal risk factors (Table 4.17). The Pearson's Chi-squared test showed a significant statistical difference in the number of risk factors for referred women in the two periods ($p=0.028$).

Table 4.17: Number of antenatal risk factors in 2005 and 2013

Number of antenatal risk factors	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
0	16 (11.6%)	32 (13%)	0.028
1	53 (38.4%)	74 (30.1%)	
2	43 (31.2%)	60 (24.4%)	
3	14 (10.1%)	57 (23.2%)	
4	11 (8%)	16 (6.5%)	
5	1 (0.7%)	4 (1.6%)	
6	0	3 (1.2%)	

Table 4.18 represents the most frequent antenatal risk factors experienced by referred women in the 2005 and 2013 samples. It shows that previous caesarean section was the most frequent antenatal risk factor in both years. The other risk factors are listed below. The “others” category includes less frequent antenatal risk factors, which are listed in table 4.19. The Pearson's Chi-squared test showed a significant statistical difference in antenatal risk factors for referred women in the two periods ($p < 0.001$).

Table 4.18: Antenatal risk factors experienced by referred women in the 2005 and 2013

Antenatal risk factors	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Previous caesarean section	31 (12.5%)	56 (11.1%)	< 0.001
Obesity	27 (11%)	50 (9.9%)	
HIV	24 (9.8%)	50 (9.9%)	
Prolonged pregnancy	15 (6.1)	51 (10.1)	
Tobacco user	15 (6.1%)	42 (8.3%)	
Raised blood pressure and/or proteinuria	10 (4.1%)	36 (7.1%)	
Prelabour rupture of membranes	26 (10.6%)	18 (3.6%)	
Anaemia	10 (4.1%)	28 (5.5%)	
Previous gestational hypertension and/or proteinuria	11 (4.5%)	20 (4%)	
Age less than 18 years	11 (4.5%)	14 (2.8%)	
Morbid obesity	8 (3.3%)	15 (3%)	
Asthma	5 (2%)	9 (1.8%)	
Decreased fetal movement	0	14 (2.8%)	
Alcohol user	0	14 (2.8%)	
Preterm prelabour rupture of membranes	11 (4.5%)	4 (0.8%)	
Rhesus negative	3 (1.2%)	8 (1.6%)	
Previous stillbirth	7 (2.9%)	5 (1%)	
Previous preterm labour	3 (1.2%)	6 (1.2%)	
Antepartum haemorrhage	0	9 (1.8%)	
Age more than 38 years	3 (1.2%)	5 (1%)	
Malpresentation at 36 weeks	3 (1.2%)	5 (1%)	
Multiple pregnancy	4 (1.6%)	4 (0.8%)	
Oligohydramnios	0	5 (1%)	
Epilepsy	4 (1.6%)	0	
5 or more previous deliveries	3 (1.2%)	0	
Previous gestational diabetes	0	3 (0.6%)	
Previous neonatal death	0	3 (0.6%)	
Others	11 (4.5%)	30 (6%)	

Table 4.19: less frequent antenatal risk factors experienced by referred women in the 2005 and 2013

Antenatal risk factors	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	< 0.001
Chronic hypertension	0	2 (0.4%)	
Dagga user	0	1 (0.2%)	
Heroin user	0	1 (0.2%)	
Impaired glucose tolerance test	0	2 (0.4%)	
Lower respiratory tract infection	1 (0.4%)	1 (0.2%)	
Large baby	2 (0.8%)	1 (0.2%)	
Mental retardation	1 (0.4%)	0	
Polyhydramnios	0	1 (0.2%)	
Previous brain tumour and ventricular-peritoneal shunt	0	1 (0.2%)	
Previous hyperthyroidism	0	1 (0.2%)	
Previous kidney stones in pregnancy	1 (0.4%)	0	
Previous postpartum haemorrhage	1 (0.4%)	2 (0.4%)	
Pyelonephritis	1 (0.4%)	2 (0.4%)	
Previous two second trimester miscarriage	2 (0.8%)	0	
Psychiatric disorder	1 (0.4%)	1 (0.2%)	
Methamphetamine “TIK” user	0	2 (0.4%)	
Cardiac disease	1 (0.4%)	1 (0.2%)	
Previous low birth weight	0	2 (0.4%)	
Previous eclampsia	0	1 (0.2%)	
Threatened preterm labour	1 (0.4%)	1 (0.2%)	
Cerebral palsy	0	1 (0.2%)	
Fetal anomaly	0	1 (0.2%)	

4.4.4 Intrapartum risk factors

In the 2005 sample, slightly less than half (48.6%) of referred women did not experience any intrapartum risk factors, with the remainder having one or more. In 2013, 45.9% of referred women did not experience any intrapartum risk factors, with the rest having one or more (Table 4.20). The Pearson's Chi-squared test showed no significant statistical difference in the numbers of intrapartum risk factors for referred women in 2005 and 2013 ($p=0.430$).

Table 4.20: Number of intrapartum risk factors in 2005 and 2013

Number of intrapartum risk factors	Number (n) and percentage (%)		p -value
	2005	2013	0.430
0	67 (48.6%)	113 (45.9%)	
1	54 (39.1%)	100 (40.7%)	
2	16 (11.6%)	25 (10.2%)	
3	1 (0.7%)	8 (3.3%)	

Table 4.21 represents the intrapartum risk factors of referred women in 2005 and 2013. It shows that the fetal distress was the most common intrapartum risk factor which the referred women experienced in 2005 and 2013. The Pearson's Chi-squared test showed a significant statistical difference in intrapartum risk factors for referred women in the two periods ($p=0.034$).

Table 4.21: Intrapartum risk factors experienced by referred women in the 2005 and 2013

Intrapartum risk factors	Number (n) and percentage (%)		<i>p</i> -value
	2005	2013	
Fetal distress	21 (23.6%)	63 (36.2%)	0.034
Failure to progress in active phase of labour	16 (18%)	29 (16.7%)	
Preterm labour	16 (18%)	17 (9.8%)	
Prolonged latent phase of labour	5 (5.6%)	18 (10.3%)	
Raised blood pressure and / or proteinuria	7 (7.9%)	11 (6.3%)	
Meconium stained amniotic fluid	4 (4.5%)	14 (8%)	
Prolonged second stage of labour	5 (5.6%)	8 (4.6%)	
Prelabour rupture of membranes	5 (5.6%)	2 (1.1%)	
Malpresentation	4 (4.5%)	2 (1.1%)	
Antepartum haemorrhage	4 (4.5%)	2 (1.1%)	
Anaemia	0	5 (2.9%)	
Cord prolapse	1 (1.1%)	1 (0.6%)	
Convulsions	1 (1.1%)	0	
Maternal tachycardia	0	1 (0.6%)	
Vaginal mass	0	1 (0.6%)	

Chapter five: Discussion

5.1 Introduction

This chapter provides a discussion of the study results, in light of the study objectives posed in the introductory chapter and attempts to put the findings within a global and national context, where possible. It also discusses the strengths and the limitations of the study. Based on the study findings, a conclusion is drawn and a recommendation is summarised.

5.2 Socio-demographic characteristics

5.2.1 Maternal age

According to Statistics South Africa (2015:16), the median age of mothers who gave birth in 2010 and 2014 was 26.5 and 26.8 years of age respectively. In general, the age pattern was constant over the two periods, with women aged 20 -24 years recording higher numbers of births, followed by women aged 25 to 29 years of age and then, women aged 30 to 34 years (Statistics South Africa, 2015:14). In this study, the mean age of mothers in 2005 and 2013 was 27.259 (SD \pm 6.277) and 27.326 (SD \pm 6.025) years of age, respectively (Table 4.1), which does not constitute a statistically significant difference ($p = 0.918$). As Table 4.1 shows, in both years the highest number of births was recorded among women aged 25 to 29 years, followed by the 20 to 24 year age group and the 30 to 34 year age group. There is also no statistical significant difference ($p = 0.919$) in age categories between the two periods in this study, but they do differ from the observed national situation.

Maternal age is an important variable as women aged below 20 years, as well as women aged over 40 years, experience an increased risk of pregnancy complications and adverse birth outcomes (Amelink-Verburg et al., 2009:928; Kozuki et al., 2013:1; Chen et al., 2007 :368; Smith & Pell, 2001:1). In this study, there is an observed increase in births among women aged 40 years and older, from 0.7% to 1.6%, although statistically a not significant difference ($p=0.919$), whereas the number of births among women aged below 20 years, remained stable at around 12% during the two periods.

5.2.2 Marital status

There have been studies that suggest that male involvement in maternal health care can improve maternal and neonatal outcomes (Mullany, Becker & Hindin 2007:166; Ampt et al., 2015:122). However, nationally, more than two thirds of births registered in 2014 did not include details of the father (Statistics South Africa, 2015:6). Similar findings from a study conducted in Cape Town found that 60% of the study sample of pregnant women were single (Nhemachena, 2011:26). In this study, a significant statistical difference ($p < 0.001$) in marital status was observed, with an increase in single status, from 52.2% to 72.4% between 2005 and 2013 (Table 4.2). These findings are consistent with national and local observations.

5.2.3 Employment status

Unemployment is a major socio-economic problem in South Africa, especially among women, of whom an estimated 28.7% are unemployed compared to 24.4% of men (Department of Women, 2015:71-72) with similar figures reported for the City of Cape Town (Western Cape Government, 2012:38). According to the Statistics South Africa report for 2013, the Western Cape experienced an increase in unemployment among women in the period between 2003 and 2013 from 23.7% to 24.9%. However, in this study 54.3% of women were unemployed in 2005, increasing to 69.9% in 2013 (Table 4.3), which is a statistically significant difference ($p < 0.001$). The reasons for this were not evident from this study.

5.2.4 Maternal education

The education level of women is not assessed in this study as it is not recorded in the folders. Pregnant women who lack social support, have low income and are uneducated are least likely to seek perinatal care (American Psychology Association [APA], 2016). However, in this study, this did not seem to have affected the women from presenting for antenatal care (section 5.3.3). They are also exposed to high levels of stress, which can negatively impact on maternal mental health and pregnancy outcomes (Vijayaselvi et al., 2015:3; Gopichandran et al., 2010:184; APA, 2016; Chandran et al., 2002:501). The overall socio-economic status of

the women in this study reflects the fact that women who utilise Cape Town Metro West health services mainly reside in poor, urban, coloured or black communities that have been disadvantaged under Apartheid, or have migrated from rural provinces (Fawcus, de Groot & Isaacs, 2005: 1257).

5.2.5 Race and Area of residence

The legacy of apartheid and forced removals is still visible in Cape Town as residential suburbs largely remain segregated along racial lines (South African History Online, 2016). According to the Regional Development Profile (2013), the racial make-up of the City of Cape Town consists of 38.6% Black, 42.4% Coloured, 15.7% White and 1.4% Indian or Asian. This represents a change in proportion since 2001 as the Black segment increased from 31.7%, whereas the Coloured and White segments decreased from 48.1% and 18.8% respectively (Western Cape Government, 2013:8). In this study the proportion of black women was 68.8% and 57.7% for 2005 and 2013 respectively, and coloured women, 31.2% and 41.1% (Table 4.4). Although, a decrease was observed in the proportion of black women and an increase in the proportion of coloured women, this difference in racial composition is not statistically significant ($p = 0.056$). This could be due to small sample size and could prove significant with a larger sample.

This study shows a significant statistical difference ($p = 0.001$) in the areas of residence as a result of the changes in the referral route within the Cape Town Metro West health system. As Table 4.5 shows, in 2013, 2 areas of residence (Retreat and Southern Peninsula) were recorded in 2013 that were previously not accommodated in 2005 and this probably contributed to the change in the race category of the patients, as the MOUs in these areas serve a predominantly coloured community, whereas Khayelitsha, which no longer refers to MMH, is a predominantly black community. This may also have contributed to an increase in the number of deliveries and workload at MMH in 2013.

An MMH and MOU's annual report (2003:10) reported an increasing influx of high risk women from the Eastern Cape into the Cape Town Metro West region. This study did not

examine intra-provincial migration by recording the province of origin of referred women as it was not indicated in hospital folders and it was not possible to trace the women who gave birth in 2005 and 2013. However, this study identified one unbooked patient who had recently arrived from the Eastern Cape in 2013 (to attend a funeral), with previous obstetric complication. Similar situations have been mentioned by health staff at MMH. With regards to the international migration, this study identified that in 2005, only two women were foreigners, whereas in 2013, 27 were from other African countries, decreasing the South African proportion of the sample from 98.6% to 89% (Table 4.6), although deemed statistically not significant difference ($p = 0.108$). The utilisation of obstetric services by migrants could have contributed to some degree to an increase in the number of deliveries and an overutilization of obstetric facilities, which needs to be assessed and monitored.

5.3 Antenatal and labour care and referral pathway

5.3.1 Parity and gravidity

According to Statistics South Africa 2015, there has been a decrease in average parities since 1996. The South African government is committed to an expanded fertility planning programme and since 2001, a wide range of contraceptives has been freely available in public medical facilities in conjunction with family planning awareness campaigns (Statistics South Africa, 2015:17). The Western Cape has the lowest fertility rate, along with Gauteng, although average parities have decreased for all provinces (Statistics South Africa, 2015: v).

In this study, the median parity for 2005 and 2013 was 1 for both years, although the IQR was from 0 to 2 and from 0 to 1, respectively (Table 4.7). There is a significant statistical difference in the mean parity and gravidity of referred women in both periods ($p= 0.029$ and $p= 0.042$, respectively).

Gravidity and parity are important variables as high parity and high gravidity increase complications during pregnancy, childbirth and postpartum (Akter et al., 2013:1; Kozuki et al., 2013:1; Hoque, Hoque & Kader, 2008:25). The study also observed that the range of parity decreased from 0 to 8 in 2005 to 0 to 6 in 2013, and the range of gravidity decreased

from 1 to 11 and to 1 to 7 (Table 4.8). However, these changes are not statistically significant ($p = 0.216$).

The decrease in mean parity and gravidity could be a reflection of successful family planning interventions. It was noted that all booked patients in this study received contraceptive counselling during ANC visits and were offered a range of contraceptive methods.

5.3.2 Antenatal clinics attended

The WHO recommends that ANC clinics should be accessible within the service area (WHO, 2006:1). In this study, comparing the area of residence (Table 4.5) with antenatal clinic attended (Table 4.10), shows that the obstetric facilities provide good coverage for antenatal care. Also, a significant statistical difference ($p < 0.001$) in the antenatal clinic attended could be explained by the change in the referral pathway.

5.3.3 Number of ANC visits

Antenatal care is a critical opportunity for pregnant women to receive care, support and health education. This includes the detection and prevention of disease, as well as family planning counselling (WHO, 2016). Timely and frequent ANC visits enable women to obtain the full benefits of pregnancy interventions. The WHO also recommends that every pregnant woman should have at least four ANC visits assisted by a suitably skilled person, commencing as soon as possible (WHO, 2006:1).

Worldwide, 64% of pregnant women received this recommended minimum number of visits, whereas in South Africa the figure stands at 87%, during the same period from 2007 to 2014 (WHO, 2015:96; WHO, 2016). The improvement in ANC coverage, especially since democratisation of the country, is recorded in different provinces across South Africa (Tsoka, Le Sueur & Sharp, 2003:70; Hoque, Hoque & Kader, 2008:66a). In this study, most women were booked at antenatal clinics, increasing slightly from 94.2% in 2005 to 95.1% in 2013 (Table 4.9), although it is not a statistically significant difference ($p = 0.697$). The median

number of ANC visits increased significantly ($p = 0.013$) from 5 in 2005 to 6 in 2013 (Table 4.11), both of which exceed the WHO recommended minimum.

5.3.4 Gestational age at first ANC visit

The risk status of pregnant women is assessed at the first antenatal visit, hence booking is advocated before 20 weeks gestation. At each subsequent visit the risk status is reassessed, to facilitate appropriate referral and to prepare the woman for delivery at the designated health facility (DoH, 2013). Early antenatal care attendance plays a significant role in detecting and treating some complications of pregnancy. It also forms a good basis for appropriate management during delivery and after childbirth (Gebremeskel, Dibaba & Admassu, 2015:2). For HIV positive women in particular, early ANC attendance is vital as early initiation of anti-retroviral treatment (ART) can reduce mother to child transmission risk and maternal mortality (Li et al., 2014 Cited in Statistics South Africa 2015:15). Furthermore, early booking offers the opportunity for early and accurate ultrasound dating, improving the identification of either preterm labour or prolonged pregnancies at risk of complications for optimal obstetric care (Caughey, Nicholson & Washington, 2008: 703.e1; Taipale & Hiilesmaa, 2001: 189). Many of these opportunities are missed due to failure to attend antenatal care early (Gebremeskel, Dibaba, & Admassu, 2015:2).

South African studies have reported on late booking in Cape Town (Nhemachena, 2011:26) and other provinces (Hoque, Hoque & Kader, 2008:66a; Horner & Mashamba, 2014:135). However, the Statistics South Africa (2015:15) report indicated that, in the Western Cape Province, there was an increase in the proportion of women attending ANC clinics before 20 weeks, from 51.6% in 2010 to 63.3% in 2014. This study observed a significant improvement ($p < 0.001$) in the median gestational age at first ANC visit from 24 to 19 weeks during the two periods (Table 4.11).

This improvement could be explained by increased awareness and education in communities regarding the importance of early ANC attendance. There has been a big campaign by the department of health to promote booking before 20 weeks and MOUs strive to meet the

target. Women also book earlier, because of the opportunity to get an ultrasound scan. In addition, due to the increased availability of cheap and effective urine pregnancy tests, women are self-diagnosing pregnancy earlier and as a result, start attending ANC clinics earlier (personal communication with Prof. Susan Fawcus, head of Obstetrics, MMH, 31 January 2017).

5.3.5 Source of referral

The identification and referral of complicated pregnancies, whether during the antenatal period or during labour, is a vital function of primary level health care facilities (DoH, 2007:13). This study shows that most referrals occurred during the antenatal period, 65.9% in 2005 and 68.3% in 2013 (Table 4.13), with no significant statistical difference ($p = 0.637$) between the two periods. Most referrals were from MOUs and there is a significant statistical difference ($p < 0.001$) in the source of referrals during the two periods, the proportion of referrals from MOUs having decreased and referrals from public hospitals having increased (Table 4.13). The proportion of patients referred from clinics also increased. This could be explained by the change in referral pathways. False Bay Hospital and Retreat MOU started referring patients to MMH in 2013, while Khayelitsha MOU discontinued its referrals. In addition, basic antenatal clinics were established at several new sites. Moreover, the proportion of self-referrals dropped, which could be a reflection of the strict implementation of maternity referral system rule. However, it is important to note that MMH does not refuse any self-referral presenting during labour. This study also did not assess the number of self-referrals during the antenatal period that were referred back to MOUs. The decrease in self-referrals could also be explained by an increase in community awareness and acceptance of the services offered by local MOUs, boosted by the establishing of high risk clinics, where pregnant women can be seen by doctors at the MOUs. Further studies are needed to explore this.

5.3.6 Mode of delivery

The caesarean section rate is one of the main indicators of access to EmOC (WHO, 2009:10). Despite being a life-saving surgery when certain complications arise during pregnancy and labour, it remains a major surgery with concomitant maternal and perinatal risks, as well as

having potential implications for future pregnancies (Gregory et al., 2012:7). Worldwide, there has been a dramatic increase in caesarean section during the last few decades (Betrán et al., 2016:2). South Africa has also seen an increase in the caesarean section rate. For example there was an increase from 18.4% between 2005 and 2007 (National Committee for Confidential Enquiry into Maternal Deaths [NCCEMD], 2008:19) to 23.2% for the period between 2011 and 2013 (NCCEMD, 2014:34).

The rate of caesarean section at MMH has increased from 9.9% in 1994 to 19.5% in 2003, and remaining relatively stable at 20.7% in 2009 (Horak, 2012:48). In this study, the caesarean section rate was 40.6% in 2005 and 48% in 2013, whereas normal vaginal delivery was 55.8% and 50.8% for the two periods, respectively (Table 4.12). Although an increase in caesarean section was observed, and a decrease in normal vaginal and assisted deliveries, the difference is not statistically significant ($p = 0.139$). The observed high rate of the caesarean section could be explained by high proportion of high risk patients being managed at the hospital.

5.4 Appropriateness of referrals

5.4.1 Reason for referral

The reasons for referral differ between and within countries according to local epidemiological conditions. For example, studies in a high income country show that the main reasons for referral are previous caesarean sections, meconium-stained amniotic fluid, demanding pain relief and lack of progress of labour (Amelink-Verburg et al., 2009:928; Offerhaus et al., 2013:195). In low income countries, studies highlight five or more previous pregnancies and maternal age below 20 years being the main reasons in Rufiji district, Tanzania, and Gutu District, Zimbabwe (Pembe et al., 2010:1; Majoko et al., 2005:656), whereas failure to progress and hypertension were the most common reasons for referral in Accra, Ghana, (Nkyekeyer 2000:811). However, in Lusaka district, Zambia, the main indication for referral was that the patient presented while in labour without complications, that is a self-referral (Murray et al., 2001: 356).

In this study, there were many reasons for referral as shown in Tables 4.14 and 4.15. The main three reasons for referral in 2005 were previous caesarean section (18.8%), prelabour rupture of membranes (12.3%) and raised blood pressure and/or proteinuria (11.6%). In 2013, the main three reasons for referral were previous caesarean section (19.9%), prolonged pregnancy (18.3%) and raised blood pressure and/or proteinuria (11.4%). There was only one patient who presented during labour in 2005 without previous or current risk factors. There is a significant statistical difference ($p < 0.001$) in reasons for referral for women who gave birth at MMH in 2005 and 2013.

In this study, there is an increase in referrals due to prolonged pregnancy, from 7.9% in 2005 to 18.3% in 2013. Given that the referral criteria for prolonged pregnancy and preterm labour remained unchanged between 2005 and 2013 (Appendix 2 and 3), earlier booking (section 5.3.4) and, consequently, early and accurate ultrasound dating could possibly have resulted in more prolonged pregnancies being diagnosed and referred. This could also explain the decrease in preterm prelabour rupture of membranes from 7.9% in 2005 to 1.6% in 2013 and preterm labour from 4.3 % in 2005 to 4.1 % in 2013 (personal communication with Prof. Susan Fawcus, head of Obstetrics, MMH, 31 January 2017).

Between 2005 and 2013, there was also a slight increase in referrals due to prolonged labour; during the latent phase from 2.1% to 4.5%, during the active phase from 5.1% to 5.7% and during the second stage from 1.4% to 2.4%. This could be related to the extensive feedback from MMH community medical officers regarding the need to reduce hypoxic ischaemic encephalopathy (HIE) due to prolonged labour. This could have resulted in MOUs referring more patients. Also, the new department of health partogram has the action line drawn 2 hours to the right of the alert line, whereas it was previously at 4 hours. Consequently, prolonged labour is being detected earlier, resulting in more referrals (personal communication with Prof. Susan Fawcus, head of Obstetrics, MMH, 31 January 2017).

5.4.2 Risk category

The World Health Organisation defined the users of referral level obstetric care as women with high risk pregnancies who require interventions by doctors (WHO, 1991 cited in Jahn, Kowalewski & Kimatta, 1998:929). However, a South African study has shown that a high proportion of deliveries at hospital (67.5%) were, in fact, low risk, and could have been managed at lower level obstetric facilities (Mbowini, 2012:39). In this study, 97.8% and 100% of patients were considered high-risk in 2005 and 2013 respectively (Table 4.16), and therefore, appropriate referrals. There was a significant statistical difference ($p = 0.02$) in the risk category in the two periods. Of the 3 (2.2%) low risk referrals in 2005, only two were inappropriate as they concerned one unbooked patient presenting with no complications during active labour and one tubal ligation patient. According to 2005 referral criteria for level 1 facilities, the latter should have been referred postpartum. The remaining low risk referral constituted an appropriate referral as per the protocol regarding adoption.

The findings in this study are different from the previous study in South Africa, as it reflects an appropriate utilisation of obstetric services with the Cape Town Metro West health system. It is clear that midwives at MOUs are competent in identifying and referring women with complications during pregnancy and labour. Also, protocols which emphasize the use of partograms are firmly in place, indicated by the fact that it was included in most referred patients' folders. Furthermore, telephonic communications with doctors at MMH, prior to referral, were also noted. Doctors from MMH also provide support to MOUs by conducting regular visits. The availability of ambulance, as well as the flying squad, transportation facilitates accessibility for high risk patients. Although maternal and pregnancy outcomes were not studied explicitly, these factors all contribute to a well-functioning referral system. Further research is needed to assess the effectiveness of the maternity referral system within the Cape Town Metro West health district by examining maternal and perinatal outcomes.

The Western Cape Health Department reallocated resources to primary level healthcare facilities and established a strict referral system, allowing appropriate care for all patients regardless of their risk category. The province has seen significant progress in the reduction of maternal and perinatal mortality (Kahn, 2014). According to the NCCEMD (2014:5), the

institutional MMR (iMMR) in the Western Cape was 75.99 per 100 000 live births in the triennia 2011 to 2013, which is significantly lower than the national average (158.29), as well as lower than the iMMR for the period 2008 to 2010 (84.87) (NCCEMD, 2012:9). Furthermore, the Western Cape recorded the lowest rates of stillbirth, at 17.2 per 1 000 total births, and early neonatal death, at 5.3 deaths per 1 000 live births in 2014/2015 (Massyn et al., 2015:83; Massyn et al., 2015:88).

However, the gains made by an effective referral system (the correct patients are referred efficiently) are seemingly offset by a general increase in pregnancy risk factors and labour complications. However, the increase from 97.8% to 100% of correctly transferred patients, although statistically significant, may not be clinically significant.

5.4.3 Antenatal risk factors

A South African study showed HIV, anaemia and previous caesarean sections constituted the main risk factors for patients and referrals at an MOU in Tshwane North (Horner & Mashamba, 2014:133). This study showed that most referred women in 2005 and 2013 had one, or more, antenatal risk factors (Table 4.17), and more than half experiencing intrapartum risk factors (Table 4.20). In 2005, the most common antenatal risk factors were previous caesarean section (12.5%), obesity (11%), prelabour rupture of membranes (10.6%) and HIV (9.8%) (Table 4.18). In 2013, previous caesarean section (11.1%), prolonged pregnancy (10.1), obesity (9.9%), HIV (9.9%) and tobacco use (8.3%) were the main risk factors (Table 4.18). The antenatal risk factors during the two periods are significantly different ($p < 0.001$). Contrary to the study conducted in Tshwane, this study at MMH highlighted additional “life style” risk factors such as obesity, as well as tobacco, alcohol and substance use.

The study observed an increase in tobacco use, from 6.1% in 2005 to 8.3% in 2013 and alcohol use, from zero in 2005 to 2.8% in 2013. In addition, substance abuse (Dagga, Methamphetamine “TIK” and Heroin) increased from zero in 2005 to 0.8% in 2013. This study also observed an increase in raised blood pressure and/or proteinuria, from 4.1% in 2005 to 7.1% in 2013.

According to the Saving the Mothers report for 2011 – 2013, HIV infection was most commonly associated with maternal death in South Africa (NCCEMD, 2014:18). Among the women who died, 87% were tested and, of these, 65.3% had been infected with HIV. The resulting non-pregnancy related infections were ultimately the most important cause of death (NCCEMD, 2014:18-19).

Furthermore, one of the key findings of the same report indicated that obesity posed a significant risk of pulmonary embolism particularly after caesarean section. Among women who died due to embolism, 57% were obese with a BMI greater than 30 and 18% were overweight (NCCEMD, 2014:66). Obesity increases pregnant women's risk for gestational diabetes, hypertension, thromboembolism, operative deliveries and induction (Heslehurst et al, 2006:334; Callaway et al, 2006:56).

In addition, prolonged pregnancy increases fetal distress and meconium aspiration, which are manifestations of fetal hypoxia, and therefore require interventions (Usher et al, 1988: 259). Moreover, hypertension during pregnancy is associated with significant perinatal and maternal morbidity and mortality (Liu, Cheng & Chang, 2008:130; Villar et al., 2006:922). In South Africa, hypertension is a major direct obstetric cause of maternal death, despite a slight decrease from 15.7% for the reported period 2005 to 2007, to 14.77% for the reported period 2011 to 2013 (NCCEMD, 2014:6).

Tobacco and alcohol use remains a significant feature among pregnant women from socio-economically disadvantaged communities in the Western Cape (Croxford & Viljoen, 1999:962). It is widely known that tobacco smoking during pregnancy is linked to restricted fetal growth, low birth weight, recurrent miscarriage, stillbirth, preterm labour and neurobehavioural effects later in life (Albuquerquea et al., 2004:31; Shivericka & Salafia, 1999:268; Rogers, 2009:155-156; Rogers, 2008:2). Alcohol use is also a leading cause of intra-uterine growth restriction, neural and facial abnormalities, as well as organ malformations. These characteristics are collectively known as Fetal Alcohol Syndrome

(FAS) (Centers for Disease Control and Prevention [CDC], 1997: 346; Jones & Smith, 1975:1).

5.4.4 Intrapartum risk factors

This study also identifies intrapartum risk factors (Table 4.21). The main intrapartum risk factor in 2005 and 2013 was fetal distress, which usually arises when the fetus does not receive enough oxygen (Karabulut & Ibriki, 2014:32). It may occur when pregnancy is prolonged or due to pregnancy induced hypertension. This risk factor requires intervention to prevent fetal death or other neurological complications (American Pregnancy Association, 2015). In 2005, fetal distress accounted for 23.6%, followed by failure to progress and preterm labour at 18% each. In 2013, the proportion of fetal distress climbed to 36.2%, followed by failure to progress (16.7%). There was a significant statistical difference ($p = 0.034$) in intrapartum risk factors during the two periods. This study also observed an increase in the proportion of prolonged latent phase of labour from 5.6% in 2005 to 10.3% in 2013, as well as in meconium stained amniotic fluid from 4.5% in 2005 to 8% in 2013. All these factors increase the risk for adverse pregnancy outcomes and the need for interventions provided at higher levels of obstetric care.

5.5 Study strengths

One of the main strengths of this study is the relatively long interval between the two periods that were examined (2005 and 2013), during which there were changes to the referral pathway, as well as patients' characteristics, both clinical and socio-demographic. This allowed a comparison to be made between referrals during the two periods in order to identify the differences.

In addition, the data collected in this study also highlighted the risk profile of the referrals, which is important to health managers for planning purposes, particularly, since no studies, to date, have listed the distribution of risk factors for referrals at MMH. This study also evaluated the effectiveness of the maternity referral system within the Cape Town Metro

West health system, through assessing the appropriateness of referrals. This serves as a monitor for the utilisation of secondary level obstetric services.

5.6 Study limitations

The study was based on data collected from patient folders. As mentioned previously, there were some folders missing data. In addition, there had been changes in the design of the antenatal card, which could pose a minor limitation to the study in that there was inconsistent recording of some of the risk factors. In 2005, only smoking habits were recorded on the antenatal card, whereas the new antenatal booklet used in 2013 records alcohol and drugs consumption, in addition to smoking habits.

5.7 Conclusion

The Cape Town Metro West health system features a functional maternity referral system.

Midwives perform well in referring pregnant women who meet the criteria for high risk.

There has been an increase in the number of women referred to the MMH over the study period but in this study group all referrals were found to be appropriate and were compliant with relevant obstetric management protocols

There have not been large shifts in the demographics of referred women over the period reviewed.

The change in the referral pathway has seen Southern Peninsula and Retreat referring to MMH but Khayelitsha no longer referring there.

There are emerging risk factors that reflect the epidemiological changes currently being observed in the Cape Town Metro West region.

The existing policies and guidelines within the health system appear to be used correctly and effectively, as reflected in the appropriate referrals to MMH

5.8 Recommendations

It may be useful to have district hospitals with the capacity to perform timeous and safe caesarean sections. This may reduce congestion at MMH. Many of the caesarean sections which are done at MMH are done for mechanical obstetric reasons and for fetal distress. One of the means of reducing the number of deliveries at MMH therefore appears to be the development and use of a district hospital or hospitals with capacity to perform safe and timeous caesarean sections and also to manage some of the other patients with less serious problems requiring hospital but not level 2 care. These hospitals would also need to operate using the same referral and management criteria as are used in the whole service.

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Appendix 1: Data collection sheet**Record number:****Year.....****Section A: socio-demographic profile data**

1. Age
2. Marital Status
Married
Single
Not indicated
3. Employment status
Employed
Unemployed
Not indicated
4. Race
Coloured
Black
White
Indian
Not indicated
5. Area of Residence
Mowbray
Kenilworth
Claremont
Salt River
Observatory
Mitchell's Plain
Gugulethu
Retreat
Khayelitsha
Other (specify)
6. Nationality

Section B: antenatal and labour care and referral pathway

4. Parity	
5. Gravity	
6. Booked at antenatal clinic?	Yes / No
7. If yes, which antenatal clinic attended?	
Mowbray Maternity Hospital's clinic	
Hanover Park MOU	
Mitchell's Plain MOU	
Gugulethu MOU	
Retreat MOU	
Khayelitsha MOU	
Liesbeeck MOU	
False Bay hospital	
Others	
8. Gestational age at first ANC visit	
9. Number of ANC visits	
10. Mode of delivery	
Normal vaginal delivery	
Assisted delivery	
Caesarean Section	
11. Source of referral	
MOU	
clinic	
Self-referral	
Other public hospital	
Private hospital/midwife	
12. Category of referral	
Antenatal referral	
Intrapartum referral	

Section C: Appropriateness of referrals

1. Reason for referral
2. Risk Category
Low risk
High risk
3. If high risk which risk factor(s) had
3.1 Antenatal Risk Factors
Age less than 18
Age more than 38
5 or more previous deliveries
Substance abuse
Any medical condition (specify)
Multiple pregnancy
Antepartum haemorrhage
Raised blood pressure and/or proteinuria
Decreased fetal movement
Malpresentation at 36 weeks
Gestational diabetes
Previous caesarean section
Poor previous obstetric history
Prolonged pregnancy
Others (specify)
3.2 intrapartum risk factors
Prolonged latent phase of labour (> 12 hours)
Failure to progress in active phase of labour
Preterm labour < 36 weeks
Cord prolapse
Malpresentation
Meconium stained liquor
Others (specify)

Appendix 2: Risk factors constituting high risk pregnancies in 2011 referral criteria

Current pregnancy	<p>Age less than 18*</p> <p>Age more than 38</p> <p>Multiple pregnancy</p> <p>Antepartum haemorrhage</p> <p>Raised blood pressure and/or proteinuria (diastolic blood pressure (BP) 90 mmHg or more on two occasions, and/or systolic BP more than 150 mmHg)</p> <p>Gestational diabetes</p> <p>Decreased fetal movement</p> <p>Malpresentation at 36 weeks</p> <p>Prolonged pregnancy > 41 weeks*</p> <p>Intrauterine growth restriction *</p> <p>Large for gestational age /Polyhydramnios*</p> <p>Prelabour rupture of membranes</p> <p>Preterm prelabour rupture of membranes</p> <p>Fetal anomaly</p> <p>Substance abuse including Tik*, Dagga* and Heroin</p> <p>Weight > 120 kg</p>
Obstetric History	<p>5 or more previous deliveries</p> <p>Previous caesarean section</p> <p>Previous gestational hypertension and / or proteinuria*</p> <p>Previous eclampsia</p> <p>Previous gestational diabetes*</p> <p>Previous preterm labour*</p> <p>Previous low birth weight baby*</p> <p>Previous postpartum haemorrhage</p> <p>Poor previous obstetric outcome including previous stillbirth, previous neonatal death and previous two second trimester miscarriage</p>
Medical conditions	<p>Cardiac disease</p> <p>Asthma on treatment*</p> <p>Complicated HIV*</p>

Continue

	Chronic hypertension Anaemia (Haemoglobin < 10 mg/dl) Epilepsy* Mental disorders* Thyroid disease Renal disease Lower respiratory tract infection
During labour	Any of previous mentioned risk factors Prolonged latent phase of labour (> 12 hours) Failure to progress in active phase of labour (cross transfer line) Prolonged second stage of labour Preterm labour < 36 weeks Malpresentation Meconium stained liquor Cord prolapse Fetal distress (fetal heart rate <120, >160 or any decelerations)

* Suspected high risk pregnancies for triage to be referred to doctor's clinic at MOU

Source: adapted from protocols for clinical practice at level 1 maternity care facilities in the Metro West (2011:80-83)

Appendix 3: Risk factors constituting high risk pregnancies according to 2005 referral criteria

Current pregnancy	Age less than 18 Age more than 38 Multiple pregnancy Antepartum haemorrhage Raised blood pressure and/or proteinuria (diastolic blood pressure (BP) 90 mmHg or more on two occasions, and/or systolic BP more than 150 mmHg) Gestational diabetes Decreased fetal movement Malpresentation at 36 weeks Prolonged pregnancy > 41 weeks Intrauterine growth restriction Large for gestational age /Polyhydramnios Prelabour rupture of membranes Preterm prelabour rupture of membranes Fetal anomaly Substance abuse Tik, Dagga and Heroin
Obstetric History	5 or more previous deliveries Previous caesarean section Previous gestational hypertension and / or proteinuria Previous eclampsia Previous gestational diabetes Previous preterm labour Previous low birth weight baby Previous postpartum haemorrhage Poor previous obstetric outcome including previous stillbirth, previous neonatal death and previous two second trimester miscarriage
Medical conditions	cardiac disease asthma on treatment Complicated HIV

	Epilepsy Mental disorders Thyroid disease Renal disease lower respiratory tract infection
During labour	Any of previous mentioned risk factors Prolonged latent phase of labour (> 12 hours) Failure to progress in active phase of labour (cross transfer line) Prolonged second stage of labour Preterm labour < 36 weeks Malpresentation Meconium stained liquor Cord prolapse Fetal distress (fetal heart rate <120, >160 or any decelerations)

Source: Personal communication with Prof. Susan Fawcus, head of Obstetrics, MMH, 20 December 2016.

Appendix 4: University of Cape Town Faculty of Health Sciences Human research ethics committee approval letter



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room E52-24 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone: (021) 406 6338 • Facsimile: (021) 406 6411
Email: general@ethics.uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/Forms

05 November 2015

HREC REF: 814/2015

Dr D Greenfield
Neonatal Unit
School of Child & Adolescent Health
Rondebosch

Dear Dr Greenfield

PROJECT TITLE: ASSESSMENT OF ANTENATAL INTRAPARTUM REFERRALS AT MOWBRAY MATERNITY HOSPITAL, CAPE TOWN, SOUTH AFRICA (Mphil candidate- Ekram Slogi)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30th November 2016.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure Form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/Forms)

We acknowledge that the following student: Ekram Slogi is also involved in this project.

Please quote the HREC reference no in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Yours sincerely

Signed by candidate

Signature Removed

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.

Institutional Review Board (IRB) number: IRB00001938

This serves to confirm that the University of Cape Town Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research

Hrec/ref:814/2015

